THE
VETERINARY JOURNAL

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Biography

MAJOR-GENERAL SIR JOHN MOORE, K.C.M.G., C.B., F.R.C.V.S.

MEMBERS of the profession, and especially those who had the privilege of serving under his command in the Great War in particular, will recollect with pleasure that Major-General Sir John Moore was recently elected Commandant of the Royal Army Veterinary Corps. More recently, in succession to Lord Mildmay of Flete, he has been unanimously elected as President of the National Horse Association.

Since his retirement from the active list of the Army, Sir John has never ceased to employ himself in work for the advancement of the profession and for the welfare of the horse and horse owner. This new honour is an acknowledgment, of which the profession may also be proud, from one of the most influential of the Societies whose aim is to look after the interests of the horse.

As Chairman of the Editorial Committee of our contemporary, the *Veterinary Record*, and an energetic member of the National Veterinary Medical Association, Sir John Moore's name is always prominent where good hard work has to be done, both socially and professionally; and in this he has the whole-hearted support of Lady Moore and a family of clever daughters, one of whom is already making a name as a doctor in human medicine.

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Editorial

VETERINARY INSPECTION OF DAIRY COWS.

THE recently published report of The Milk Reorganisation Committee has suggested that the regular veterinary examination of all dairy cows producing milk for sale should be carried out without delay. The veterinary profession generally, especially through the voice of the R.C.V.S. and the N.V.M.A., has for many years been advocating this procedure, and we look upon the suggestion referred to as fully vindicating our policy. Reference to a paper recently read before the Farmers' Club, and reported in this issue of the Journal, is of especial interest at this present juncture.

While we can only rejoice that this policy has now been recognised by those responsible for advising the future lines under which milk is to be produced, we regret to find that there are many practitioners who visualise a rapid bureaucracy of whole-time veterinary officers who will oust the general practitioner from his livelihood. In our view these fears are quite unfounded, and, far from ruining the practitioner, the recommendations of the committee will not only do much to bring the veterinary profession into its own, but will have the effect of raising its status by bringing it more in line with the medical services of the country.

Have we not always felt that our services were not recognised in official quarters, and strongly deprecated this? It is evident that the wish of the committee is that the veterinary surgeon should take his place in all local administration, and the report expresses the hope that "in due course a chief veterinary inspector will take his place in the official hierarchy of a Council." It has long been one of our causes of complaint that our members have been compelled to take orders from chief constables and police superintendents, and have been entirely subservient to them, and that we have been ignored in relation to the hygiene of milk production. *We feel convinced that the suggestions now mooted would only be the first step in placing the whole supervision of our milk supply largely under our profession.*

The question of whether the work has to be done by whole- or part-time staffs must depend upon circumstances. Where it is decided to employ part-time officials who would work under the general supervision of one whole-time officer, the practitioner would be in a far stronger position than he is at the present time—acting only when called on by the police.

It should be remembered that up to now only a few English County Authorities have arranged for the regular inspection of dairy cows, and thus the appointment of some more whole-time veterinary officers for this work

would take nothing away from the majority of part-time practitioners in this respect, even though it might adversely affect them as regards their duties under the Tuberculosis Order.

The question as to whether whole- or part-time officials should be employed is always a vexed one, and is exercising the medical profession to-day just as it does ours. The whole-time veterinary officer can, and often does, advise farmers to send for his colleague, the practitioner, when he finds cases needing veterinary aid. It must not be forgotten that both whole- and part-time veterinarians belong to one and the same profession, and were those of our ranks who at present are wholly employed by Local Authorities "practising" in the same areas where they are now officials, the loss in the balance sheet of existing practitioners would be vastly greater.

General Articles

THE INSPECTION OF DAIRY HERDS.*

By THOMAS BAXTER,

Ex-President and Chairman of the Milk and Dairy Produce Committee of the National Farmers' Union.

THE request that I should read this paper reached me, as I need hardly say, some time before the Report of the Milk Reorganisation Commission was published, and I had practically completed my notes before I had the opportunity of reading the Report. I expect that practically everyone present has read what the Reorganisation Commission has to say on the subject of the grades and quality of milk, and there is no need for me to stress the importance of the subject.

The chief reason which induced me to accept the invitation to read a paper on " The Inspection of Dairy Herds " was that it gave me an opportunity of putting in a word in defence of the dairy farmer. I think we all ought to follow the excellent example which has been set by the present Minister of Agriculture. I was at a gathering last month where he pointed out the importance of British farming, not merely in the economic life of this country, but in the economic life of the Empire as a whole. He reminded us that actually there were more people engaged on the land in this country than in any of the Dominions. That is a fact which is very frequently overlooked, and because it is overlooked we farmers are rather apt to neglect such opportunities as are given to us of correcting the misapprehensions that exist in regard to the various branches of our industry.

Dairy farming, as you all know, is one of the most important branches of home agriculture, and there is increasing appreciation of the value of milk as a food. But side by side with that increasing appreciation of the food value of milk there has recently been a tendency in certain quarters to make the most ill-conceived attacks upon the quality of the nation's milk supply. I welcome the opportunity given me of combating that tendency. As some of you may know, I have been associated for a good many years with the work of the Milk and Dairy Produce Committee of the National Farmers' Union, which, as will be generally conceded, is fairly representative of the dairy farmers of England and Wales, and I can assure you from my personal knowledge of the facts that the organised dairy farmers of this country are as keen as anyone else on seeing that the housewife is provided with a thoroughly reliable milk supply.

When the present Milk and Dairies Order was first published in draft, we collaborated whole-heartedly with the Ministry of Health in securing that its provisions should be workable and effective. We collaborated with the same department in regard to the Milk (Special Designations) Order, and again our objective was to serve the interests both of our producing members and of the consuming public. We realised thoroughly that the well-being of dairy farmers is not to be

* Paper read at a Meeting of The Farmers' Club, on February 27th, 1933. Reprinted from the *Journal of the Farmers' Club*, March, 1933.

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achieved and maintained on the basis of anything but a clean and wholesome supply of milk. In my view the Government Departments concerned have, broadly speaking, taken a wise and sympathetic view of their responsibilities in regard to the milk supply from the public health standpoint, and by so doing they have contributed very largely to the progressive improvement which has taken place in regard to milk coming on the liquid market for a good many years past. The developments that have taken place in connection with the milk industry have taught farmers their responsibility in the matter, and they have acted up to it. That is why the Editor of the *British Medical Journal* was able to testify not long ago that the milk industry " has made greater advances during the last decade than any other industry connected with our food supplies." Similar tributes have been paid by medical officers of health and others who are in a position to know, and we have it on impartial authority that no country in the world has a better milk supply than has Great Britain.

Now in saying that I do not wish to suggest for one moment that our dairy farmers can rest on their oars, and that further improvements are impossible. What I am concerned to stress is that critics of our milk supply are damaging their own cause every time they attempt to persuade the housewife that fresh milk is dangerous. I do not pretend to be a medical expert or a public health expert, but I assert with a good deal of confidence that more infantile mortality and more infantile diseases are to be ascribed to lack of fresh milk than to the consumption of fresh milk. I do not believe that the health of the nation is promoted by frightening the housewife from buying a liberal supply of fresh milk, and so inducing her to buy the imported skimmed condensed variety. And for these reasons I think that the critics of our milk supply to whom I have referred would serve their own purpose far better if they joined with those engaged in the milk industry, producers and distributors, in fostering the efforts which are consistently being made to maintain the progressive improvement in the nation's milk supplies.

I suppose that it was the controversy created by the projected Manchester Corporation Bill that was partly, if not wholly, responsible for my being invited to read this paper. I am perfectly prepared to believe that the Manchester City Council acted in a sincere belief that they were doing the right thing when they framed the provisions of their Bill relating to control of the milk entering the city. I say that because I have read something of the defence of these provisions, but I am confident that those members of the Manchester Corporation who believed most firmly in the wisdom of these provisions were profoundly mistaken. They were tackling the subject from the wrong end. They contemplated a line of action which would have done immeasurable harm to great numbers of people engaged in the milk industry, and I believe that, from the point of view of encouraging the production of pure milk, they would have set back the clock had their Bill become law. The enactment of the Manchester Bill would have been followed, doubtless, by the promotion of similar measures by other municipalities. I am heartily glad, therefore, that the Manchester Corporation Bill

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was defeated, first at a town's meeting, and subsequently at a poll of the ratepayers, and I trust that the Manchester Corporation will not attempt to revive their proposals. The Milk Reorganisation Commission, which, as you know, was composed of men wholly unconnected with any section of the milk industry, has reported that pasteurisation is not, and never can be, a substitute for clean production. That is a simple statement of fact, and it means obviously that compulsory pasteurisation is not the way in which to secure the all-round purity of the nation's milk supplies.

Now while I welcome the defeat of the Manchester Corporation's proposals, I also welcome the fillip which the introduction of the Manchester proposals gave to the efforts that are going on all over the country to improve the quality of raw milk supplies. At the headquarters of the National Farmers' Union we are in constant touch year by year with the Dairy Commissioner of the Ministry of Agriculture, and we have co-operated with him at every opportunity in promoting through the machinery of our county and local branches every effort to foster clean milk production, and I can assure those of you who have read what the Milk Commission has to say in regard to the grading and quality of milk that all these matters have been the subject of communications by N.F.U. headquarters to our county branches within recent months. Only recently, for example, we circularised our branches to ascertain whether the dairy herds in their respective areas were regularly examined by veterinary officers appointed by the County Council. Our Milk and Dairy Produce Committee also adopted a resolution last year which, amongst other things, expressed the view that the admitted improvement in the raw milk supply of the country could best be maintained by the periodical examination of dairy herds by veterinary inspectors. When the matter was under discussion by the Committee, and later by the Council of the Union, many members bore testimony to the satisfactory state of affairs that existed in those counties where the local authorities had instituted a regular inspection of dairy herds. It may well have been that the institution of such inspection met with a certain amount of opposition at the outset, but my information goes to show that farmers who have had the advantage of the help afforded to them by these inspections would be most unwilling now to revert to the old order of things. It has meant a saving of livestock and cash to the dairy farmer. It may be worth while in that connection for me to read you the following extract from the Fifth Annual Report of the Chief Veterinary Officer to the West Riding County Council :—

" The year completed on March 31st, 1932, is only the third in which regular routine veterinary inspection has been carried out on the milk-producing herds in all parts of the Administrative County area. During the time that regular inspections have been carried out the results have shown that their institution was well justified, not only from the number of dangerous cows that have been removed from the herds, but also from the distinct improvement shown in the methods of milk production in many areas, and the general interest these

inspections produce amongst all concerned. Another pleasing aspect is that several local sanitary authorities have asked that the veterinary inspections should be carried out more frequently, showing how much they appreciate their utility. As far as possible, arrangements have been made to meet their wishes, but with the present staff no further increased inspections can be undertaken."

You will have observed that the Milk Reorganisation Commission recommended that :

" For the efficient operation of the Milk and Dairies Order and the Tuberculosis Order a whole-time veterinary service is essential. The provision of an adequate veterinary service should be encouraged by substantial assistance from State funds. The appointment of a whole-time chief veterinary inspector by the council of each county and county borough is the irreducible minimum."

My quotation is from the summary of the Commission's recommendations. Some difference of opinion exists, I know, as to whether the routine inspection of dairy cattle should be undertaken by county authorities or by the veterinary staff of the Ministry of Agriculture. Foot-and-mouth disease, swine fever and the importation of animals are already dealt with directly by that Department, and in some quarters the view is held that it would be more economical and efficient if the whole work of animal disease and tuberculosis inspection were controlled under one central head: in other words, if it were performed as a State Veterinary Service. Those who hold this view argue that a properly organised State service should be cheaper and should conduce to greater uniformity of action, and therefore to greater efficiency, than an aggregation of whole-time veterinary staffs under local authorities, which would still call for the present Central Veterinary Staff of the Ministry to carry out the special duties it is found necessary for them to undertake. The advocates of such a State Veterinary Service admit that it might be necessary in addition to employ part-time veterinary surgeons for certain routine duties in connection with diseases, and also to retain sanitary officers to undertake the work of the sanitary inspection of cow-houses and buildings in collaboration with the whole-time veterinary officers. On the other hand, as I have stated, the results in some areas in which local authorities have instituted regular inspections of dairy herds by whole-time veterinary officers appear to be satisfactory. It seems to be generally agreed that the work must be undertaken by whole-time veterinary officers, and that it is impossible for part-time officers successfully to cope with it. Experience also seems to show that the inspection of herds must be made at least twice a year to be at all effective, and that the most satisfactory results have been achieved in counties where these inspections are carried out three and four times per annum.

I have quoted the recommendation of the Milk Reorganisation Commission, but obviously it is not my business this afternoon to pass judgment upon it. The whole Report is now under the consideration of the county branches of the National Farmers' Union, and in due course their findings will be reviewed by the Committee at headquarters, of which I am Chairman. One thing is quite

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obvious, and that is that in the existing economic circumstances of milk producers they cannot be expected to shoulder the cost of any veterinary inspection service, local or State, that may ultimately be instituted. Subject to that important consideration, I have no hesitation in saying that dairy farmers generally will be most willing to adopt any reasonable suggestion that may be made with a view to strengthening still further public confidence in the quality of the nation's milk supply. There is general agreement that the *per capita* consumption of liquid milk in Great Britain is too low, and that even when the consumption of milk products is taken into account there is room for a considerable increase in the consumption of fresh milk in the best interests of the community at large. Some of us have been working for a good many years now to improve the organisation of the milk industry, and our efforts have not been without a measure of success. It seems likely that the Report of the Reorganisation Commission, even if its recommendations are not adopted as they stand, will lead to further marked developments in the organisation of the industry, and I am confident that amongst these developments will be a noticeable extension of publicity work based upon enhanced confidence in the trustworthiness of the milk supply. I cannot do better, then, than conclude by reiterating the view which I have already expressed: attacks upon the milk industry are harmful in every way. Much has been done in the way of assuring a safe milk supply to the consuming public, and the results of these efforts equal anything achieved abroad. It is up to the milk industry to maintain the position which it has won, and it is up to all of us here, gathered under the auspices of the Farmers' Club, to tell the consuming public at every opportunity that may be given to us that the slogan "Drink More Milk" is one which may be adopted with every assurance that the commodity offered is full value for the price paid for it.

BACTERIAL PYELONEPHRITIS OF DAIRY CATTLE.

By J. W. HALL MASHETER, M.R.C.V.S.
Newnham-on-Severn.

DISEASES of dairy cows are so many and so varied, and so much attention has been paid to them in recent years both by practitioners and research institutes, that it makes the choice of an article for the dairy number of THE VETERINARY JOURNAL very difficult. The readers of this Journal are as a rule those who take a great interest in the work of the profession (and so more critical) that it makes the choice still harder. It is true that any one disease can be still further elaborated as to ætiology, pathology, physiology and treatment, and the different views taken by different people. That, too, does not make one's choice any easier; but if only one thought can be brought forward it may probably lead to someone more capable taking it up, investigating it, and adding a little more to the knowledge of the whole, or rekindling the interest of the apathetic. The diseases of the kidney in dairy cows require more thought and investigation than hitherto, for one sees so little in our current literature about them. What

I have in my mind is the bacterial invasion of the renal pelvis, and even of the kidneys themselves. I frankly admit that what I have to write will be mainly culled from text-books, and I also acknowledge that I, too, have neglected this aspect of our work ; but that is no reason why a start should not be made, and the thought put forward.

Bacterial pyelonephritis is an inflammation of the kidneys which usually runs a chronic course, and is characterised by small softened foci in the cortical portion, diphtheritic disintegration of the papillæ, involvement of the renal pelvis, and usually also of the lower urinary passages. The disease is produced by various bacteria, and amongst these the *B. corynebacillus renalis bovis*. It occurs almost exclusively in cows, hence this article. It is stated that pyelonephritis is very common in cows, but I cannot say that I have noticed many references to it in our literature. No doubt this is due to want of care in diagnosis, and to the paucity of post-mortems made. Cows are particularly affected shortly after calving. Possibly this, if due care was taken to diagnose the many cases of post-partum recumbency as apart from milk fever, would be found to be due to pyelonephritis.

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On three occasions lately I have had practically the whole of the vagina covered by a close-fitting, foul-smelling diphtheroid deposit, leaving where disturbed a dark-red, angry-looking surface, which may have originated in the kidneys. As I said above, pyelonephritis is a poly-bacterial disease in the causation of which the *B. corynebacillus renalis bovis* is concerned most often, while other bacteria also take part in the infection which are capable of producing suppuration or necrosis of kidney tissue. The *B. renalis bovis* is closely related to, if not identical with, the *B. pseudo-tuberculosis ovis, i.e.* the Preisz-Nocard bacillus. Although, according to my reading, it is not determined with certainty how the natural infection is produced, the general view is that it takes place most frequently in cows a certain time after parturition, if during parturition the passages have been injured, the placenta retained, or if metritis develops. This makes it very probable that the bacteria develop quickly in the diseased genitalia, and may enter the urinary organs. Or it may be that the bacteria are absorbed by the blood and affect the kidneys in that way. Also favourable circumstances appear to be important factors in the cause of this disease. A functional irritation of the kidneys may have a predisposing effect. Another predisposing cause may be urinary stasis, whether it be due to pressure exerted by a pregnant uterus containing a big calf, a full rumen, or some disease of the urinary organs themselves. *The influence of predisposing factors may be so important that without it the pyelonephritis would not have developed.*

In well-developed cases both kidneys may be enlarged. The capsule is thickened and adherent to the cortex, the surface of the kdiney is multi-coloured ; yellowish-grey islands are prominent in the renal substance, and within these islands are suppurating foci. The dilated pelvis contains a dirty-grey fluid in which one finds pus, tissue shreds, blood clots and calcareous matter, or the

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whole kidney may be transformed into a pus sac. This latter, I take it, strengthens the view that the renal bacillus and the Preisz-Nocard bacillus are one and the same. Pyelonephritis may become evident in from a few days to several months after the commencement of the primary disease. In the chronic form (which is the most frequent) the symptoms are diminished appetite, suppression of rumination and emaciation. The urine is voided fairly easily ; pressure upon the lumbar region may cause pain. A rectal examination will reveal the bladder half empty. The ureters are dilated, and feel like a firm rope passing to the kidneys. A thick purulent vaginal discharge may soil the external genitals.

On inspection, catarrhal reddening or swelling of the vaginal mucosa is seen, especially round the urethral opening. In the great majority of cases the urine is turbid, muddy, and sometimes bloody, and is strongly alkaline. Under the microscope, by Gram's stain, or even in unstained specimens of *fresh* urine, *clumped* bacilli are seen, so that in these cases I should think a true diagnosis should not present insuperable difficulties. The disease, therefore, may be recognised positively by the microscopic demonstration of the *Corynebacillus renalis*, and as the disease is caused mainly by this bacillus, it is only on this basis that a differential diagnosis can be made from the other forms of nephritis, vaginitis, cystitis, metritis and renal tuberculosis. If no symptoms exist pointing to these diseases, and if some weeks after a delivery which was not quite normal the urine contains pus, then the diagnosis of pyelonephritis can almost certainly be made, and this diagnosis can be further confirmed if one or both ureters are thickened and the kidney or kidneys are found to be enlarged.

Recovery from a well-developed pyelonephritis, as may be imagined from the clinical picture if both kidneys are affected, has never yet been observed, but the possibility of a cure is not excluded if only one kidney is diseased, and an early diagnosis of the condition is made. If a cure is attempted, then internal disinfectants are indicated, and especially those which are excreted by the kidneys.

PULMONARY TUBERCULOSIS IN DAIRY-FARM WORKERS AND OTHERS COMING MUCH IN CONTACT WITH CATTLE*

The Type of the Causal Organism in Fourteen Cases.

By W. MELROSE CUMMING,† M.D., Ph.D., D.P.H.

From Bradford City Sanatorium, Grassington, Yorks.

GRIFFITH (1932) has suggested of Scotland that if an investigation were made of cases of pulmonary tuberculosis occurring amongst those whose daily life brings them much in contact with cattle, a higher than usual proportion of bovine strains might be isolated. Lange (1931, 1932) has reported that of forty

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† In receipt of expenses grant from the Medical Research Council.

cases of pulmonary tuberculosis occurring amongst dairy farm workers, etc., in Germany, eight were due to the bovine type of the bacillus. Further, Lange is of the opinion that these cases are due to exogenous air-borne infection, *i.e.*, inhalation occurring in adult life, the vehicle of infection being either the droplets coughed out by cattle with a pulmonary lesion or the dust in the hides of the cattle.

The writer (1932 and, jointly, 1933) has reported fourteen new English cases of " bovine phthisis." Two of these cases occurred in patients who had been much in contact with cattle. Impressed by the fact that of the twelve remaining cases, ten showed definite evidence of a previous glandular lesion, and that in the two cases that came to autopsy it was established beyond reasonable doubt that the route of infection was alimentary, the writer was not disposed to place any significance on the fact that neither of the " cow-contact " cases showed evidence of this previous glandular lesion.

Pulmonary tuberculosis amongst those working with cattle would appear to be rather rare in this country, but through the kindness of Drs. Thompson Campbell, Peter Edwards, Geo. Fletcher, J. Munro Campbell, W. D. Dickson and J. Short, it has been possible to investigate fourteen cases, and of these no less than four have been shown to be due to the bovine type. To the first three named of these physicians the writer is indebted for the clinical details given below.

The methods of isolation and the criteria of type used in this investigation have been identical with those described by Cumming and Foster (1933). Sub-cultures of the bovine strains concerned and fresh specimens of sputum have been sent to Dr. A. Stanley Griffith, who confirms the writer's findings.

Clinical Notes.

Case 1.—A. W. (F.), aged twenty-eight. Lancashire, typist. Patient's father is a farmer, and she has lived on a farm all her life, but it has not been possible to elicit any evidence that during that time there had been any cattle suffering from open tuberculosis on the farm. Patient has never been a heavy milk drinker. She has suffered from pulmonary tuberculosis for not less than three years. She has also a well marked cervical glandular lesion, but on thorough investigation it was demonstrated beyond all reasonable doubt that the glandular lesion was secondary to the lung lesion. The lung lesion is extensive, bilateral, of the apically distributed superinfection type with cavitation. Sputum is 4 oz. or more in amount, and always loaded with tubercle bacilli. The prognosis is hopeless. From specimens of sputum obtained March 19th, 1932, and May 12th, 1932, tubercle bacilli were isolated, and these were later shown to belong to the bovine type.

Case 2.—W. B. (M.), aged forty. West Riding of Yorkshire, cow-hand. Patient has lived and worked on a farm in daily contact with cattle for twenty-nine years. To the best of his knowledge only four or five cattle died of pulmonary tuberculosis. During the summer months he did not drink more than one pint

of milk per week, and in the winter he drank one pint of boiled milk each night. The onset of pulmonary symptoms dates from May, 1931; the first recorded positive sputum was on August 6th, 1931, and the sputum has generally been positive since. There was no history of a previously occurring glandular lesion or other direct evidence of an alimentary route of infection. The lung lesion is reported to be of the root-spread type, and both the immediate and the ultimate prognosis are bad. From specimens of sputum obtained June 28th, 1932, and July 26th, 1932, cultures of the tubercle bacillus were grown, and these subsequently proved to be of the bovine type.

Case 3.—J. R. (M.), aged thirty-two. Cheshire, farmer. Patient has worked with cattle for eleven years, and during that time has "periodically" had tuberculous beasts under his care. He has not been a heavy milk drinker, but since 1919, when he developed diabetes mellitus, he has had up to half a pint of raw fresh cream daily. The pulmonary lesion is of not less than eighteen months' duration, the first recorded T.B. positive sputum being on March 15th, 1931. The sputum, which is scanty in amount, has generally been T.B. positive since. The lesion is of the usual apical type with cavitation, and the prognosis is poor. No history pointing to an alimentary route of infection could be elicited. From specimens of sputum obtained August 4th, 1932, and September 15th, 1932, strains of the tubercle bacillus, subsequently shown to be of the bovine type, were isolated.

Case 4.—H. J. (M.), aged twenty-seven. Cheshire, farm-labourer. Patient had worked with cattle for eleven and a-half years, but is not aware of any tuberculosis in the cattle with which he worked. He drinks milk only in tea. The pulmonary lesion, which is apical in distribution with multiple cavitation, dates from February, 1932. Sputum is scanty; the first T.B. positive result was on May 6th, 1932; since then it has been examined on eight occasions, being T.B. positive on four. There is no evidence pointing to an alimentary route of infection. The prognosis is poor. From specimens of sputum obtained August 4th, 1932, and September 15th, 1932, cultures of the tubercle bacillus were grown, and these were later shown to be of the bovine type.

Discussion.

The fact that in Cases 1 and 4 no definite evidence of contact with tuberculous cattle could be elicited is probably of little importance. In spite of the fact that Savage (1929) is of the opinion that less than 1 per cent. of infected cows in Great Britain develop "open" tuberculosis, it is, unfortunately, probably true of this country that a person could scarcely be in more or less close contact with cattle for periods of twenty-eight and eleven years respectively without meeting infective animals. Similarly, the opportunities of infection in the other two cases were probably considerably more frequent than the histories indicate.

The most interesting point for discussion, and the most difficult to settle in the light of present knowledge, is the route by which infection occurred. In Case 2 the fact that the lung lesion was reported to be of the root-spread type

suggests the possibility of a glandular lesion having preceded the lung lesion, even although there was no direct evidence of such a glandular lesion. Except for this one bare possibility, the investigation has quite failed to demonstrate any evidence of an alimentary route of infection in these four cases. This finding places this group of cases in sharp contrast with the ten cases already referred to of bovine phthisis occurring in those whose work did not bring them in contact with cattle. In these latter cases the main scource of possible infection would be the same as that of the general population, *viz.*, tuberculous milk. It would appear, therefore, that Lange's suggestion that air-borne infection with bovine tubercle bacilli does occur in cattle-workers cannot easily be refuted, and, indeed, the contrast between the present writer's two groups of cases gives some support to his suggestion. A few autopsies on such cases occurring in " cow-contacts " will be required to put the matter beyond doubt. Whatever the route of infection, these figures, taken along with Lange's, show that those coming in contact with tuberculous cattle run a very real risk of contracting from them tuberculosis in its most crippling and (if meningitis be excluded) fatal form, namely, pulmonary tuberculosis.

Griffith (1932) refers to " . . . the likelihood of persons who are discharging bovine bacilli with the sputum, if they come into contact with cattle, especially as milkers or attendants, transmitting bovine tuberculosis to the bovine animal, and thus nullifying efforts to free herds from tuberculosis." The present writer (jointly, 1933) recently wrote as follows : " That a human being with pulmonary tuberculosis due to the bovine type of the bacillus cannot infect tubercle-free cattle has yet to be proved." The importance of these suggestions will be obvious to all who know the difficulties of building up and maintaining a tubercle-free herd. The susceptibility of cattle in such herds to infection is very high. The results of the present investigation lend considerable point to these observations, since in three of the four cases referred to the patient's normal employment was the care of cattle, and they might conceivably have obtained employment in clean herds. Veterinarians might do well to keep the possibility of a human source of infection in mind when called upon to deal with an otherwise inexplicable " outbreak " of reactors in a clean herd.

Conclusions.

(1) It is reported that of fourteen cases of pulmonary tuberculosis occurring in those coming much in contact with cattle, four have been shown to be due to the bovine type of the bacillus. (2) The question of the route of infection, especially as regards the possibility of its having been respiratory, is discussed. (3) The possible significance of the findings in veterinary practice, especially as regards the maintainance of tubercle-free herds, is noted.

REFERENCES.

Cumming, W. M. : *Brit. Med. Journ.*, 1932, ii, 317.
Cumming, W. M., and Foster, W. M. : *Journ. Path. and Bact.*, 1933, 36, 1, 153.
Griffith, A. S. : *Edin. Med. Journ.*, 1932, 39, 177.
Lange, B. : *Zeitschr. f. Hyg.*, 1931, 112, 298.
Idem : *Brit. Med. Journ.*, 1932, ii, 503.
Savage, W. S. *Ibid.*, 1929, ii, 492.

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DAIRYING IN CEYLON.

By MAJOR G. W. STURGESS, I.S.O.
Late Government Veterinary Surgeon, Ceylon.

THE native cattle in Ceylon are small black or red cattle of the Zebu type. They are very poor milkers, only giving sufficient for the calf. They live on the rough pasturage, and do not receive extra feeding. The bulls are of most value to the village agriculturist, as they are used for draught purposes. They are well-shaped, powerful little animals, and well suited for the purpose. Outside the towns very little dairying is carried on. In the towns there are numerous small dairies for the sale of fresh milk. There are also many " buffalo " dairies of country-bred animals, which are small and poor milkers, mingled with the valuable milch buffaloes imported from the Bombay Presidency, which are large and good milkers, some giving over three gallons of milk per day. Generally speaking, buffalo milk is preferred by the local population, and is largely consumed as " curds " or " ghee " (clarified butter). The European population demand cows' milk, and there are numerous small private dairies supplying fresh milk twice daily to customers. In the tea-planting districts at an elevation of three to six thousand feet, imported cattle of European breeds, chiefly Shorthorns, Ayrshires and Jerseys, are kept by planters for household milk and butter supply. These are imported from Great Britain and Australia.

Before the Great War the town dairies consisted chiefly of Scinde cattle, imported from Karachi. Cows of this breed are good milkers, and stand the hot low country climate well. During the War, when supplies were not available, the dairymen were compelled to obtain European cows from the districts of high elevation. In this way a large trade developed between Colombo and the estates in the central planting districts. Cows are purchased up country and brought to Colombo for the lactation period, after which they are returned and sold back to the estates ; the business to be repeated when possible.

The milk yield of a cow is popularly referred to as so many " bottles " per day (the bottle being the ordinary spirit bottle, one-sixth of a gallon). The general yield is : native cows, three to four pints ; Scinde cows, one to two gallons ; European cows, one and a-half to three gallons per day. In most instances they support the calf as well, the custom being to take the calf to the cow at each milking-time during the whole lactation period. Cows are not sent out to pasture, but in almost all dairies they are stall fed. The foods are coconut poonac (cake), gingelly poonac (sesame cake), pollard, bran, cotton seed, dhal husk and grass, which is cultivated and cut fresh daily. The artificial foods, except coconut poonac, are imported from India.

The Government maintains a large model dairy of 150 or more cows in Colombo which supplies milk to the various hospitals. This herd was formerly composed of Scinde cattle. Experiments have been carried out as regards crossing with European bulls, and have been very successful. The most satis-

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factory cross from the dairying point of view is the Scinde-Ayrshire first cross. The crossbred progeny lose the hump of the Zebu type, have a straight back, and resemble the Ayrshire type to a very marked degree. The milking qualities are intermediate between those of Scinde and European cows. Generally speaking, the pure-bred European cow suffers much from the heat of the low country, while the local crossbreds are quite comfortable.

As regards disease, there is much to contend with, especially in the case of the European breeds. A newly imported animal will almost certainly contract piroplasmosis (*P. bigeminum*) and anaplasmosis. Ticks are a pest, and dipping or spraying is a necessity. A cause of much loss, especially amongst young stock, is worm infestation, especially by the fourth stomach worm, and continual preventive treatment is required. Tuberculosis is rare. Anthrax, coccidiosis, contagious abortion, Johne's disease, all occur. Ophthalmia often runs through a herd, and nematodes (*Thelazia sp.*) in the conjunctival sac often cause blindness. Trypanosomiasis (*surra*) is fairly common in some areas. Extensive rinderpest and foot-and-mouth disease outbreaks are often met with. Milk fever is not common, but cases do occur, and in the writer's experience are confined to European breeds. Native cows do not suffer, probably on account of their poor milking qualities. Deficiency disorders are very evident, especially a calcium deficiency, this mineral constituent being very deficient all over the country in pasture, water, and in the artificial foods available.

THE EFFECT OF BRUCELLA ABORTUS INFECTION ON THE NORMAL UDDER OF A HEALTHY COW.

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It is a natural assumption that when a pathogenic organism invades a highly specialised organ such as the bovine udder, some interference with the health and functioning of the latter must occur. In reviewing the literature on contagious abortion due to Bang's organism, it becomes apparent that while there are numerous references to the increased cell content of the milk of infected udders, to the fact that inoculation of this organism *via* the teat canal will set up a fairly acute mastitis, to groups of reacting cows giving lower milk yields than non-reactors, and a little, too, on the histopathological changes in the udder tissue induced by this type of infection, not nearly enough is known, as yet, about this most important phase of the *Brucella abortus* problem. Hence it was planned to observe the effect upon the udder of a cow that was known to be normal in every way, of an intravenous injection of living *Br. abortus*. Only one cow was used, as it was felt that to deal adequately with her alone would involve as much time as could be spared from other essential work which was proceeding simultaneously. Briefly, the object was to note the effect of the intravenous injection of *Br. abortus*

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on: (1) the agglutinating titre of the serum; (2) the appearance of agglutinins in the whey; (3) the presence of *Br. abortus* in the milk; (4) the cell content of the milk; and (5) the udder flora other than *Br. abortus*.

Particulars of the Experimental Animal.—The cow chosen was bred on the laboratory farm. She had had her third calf on 29.10.29. No evidence of disease of the udder had ever been detected, nor had she ever reacted to the agglutination test with *Br. abortus* antigens. To ensure that she was normal so far as her udder was concerned, she was kept under periodical observation by gravity cream-smear examination, and cultural tests of the gravity cream on blood agar, for approximately four months before the actual experiment was commenced. During that time no increase in cell content could be detected, and the flora averaged from 20 to 100 common udder micrococci per 0.1 c.c. gravity cream in each quarter. She was not in calf when the experiment was commenced on 27.8.30, but was served and conceived on 1.12.30. She was turned out, dry, on 8.3.31.

Methods and Technique.

Agglutinins in Serum.—Tube dilution method with antigen in routine use here; dilutions 1/25 to 1/200.

Agglutinins in Whey.—The wheys are prepared by adding two drops of commercial rennet to 10 c.c. of cream-free milk, rising to 50° C. in a water bath (by which time good clotting has usually occurred), and then allowing the tubes to cool off of themselves. When the whey has separated it is tested by Huddleson's rapid agglutination test, using antigen prepared according to his specifications. If there is any doubt whatever about the reaction, the doubtful whey is always tested by the routine tube-dilution method. Much time is saved by using the rapid test as a preliminary.

Udder Flora.—Estimation by poured plate cultures, using 5 per cent. ox-blood agar as medium and 0.1 c.c. of gravity cream as inoculum.

Br. abortus in Milk.—0.1 c.c. gravity cream again used as inoculum. Medium is 10 per cent. serum agar containing 1 part basic fuchsin or gentian violet per 50,000 parts of medium. Surface cultures are used in this case. Incubation is at 37°C. for seventy-two hours in jars containing 10 per cent. CO_2.

Cell Content Estimation.—The estimation is made by the microscopical examination of smears prepared from the gravity cream after the samples have been standing for two hours. A platinum loopful of the cream layer is spread thinly and stained with 1 per cent. methylene blue. When examining such smears with an oil immersion lens one notes the number and type of cells seen, and grades the samples accordingly by putting an arbitrary figure on them. Our method is to grade them into seven types ranging from normal, indicated by the figure 0, in which either no cells at all are seen or else very rare lymphocytes, up to acute mastitis, indicated by the figure 6, in which the smear is almost wholly composed of polynuclear leucocytes and epithelial cells. It is admitted that this is a rough-and-ready method, and that in estimating the significance of the lower grades of

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mastitis detected in this way, one had to consider the several factors, apart from infections, which tend to increase the cell content of milk, *e.g.*, the process of drying off; but as to the actual grading of samples into groups, according to the cell content shown in this way, it is a fact that with a little experience two observers examining the same batch of samples obtain surprisingly consistent results. This means of checking our results is frequently followed here in order to ensure that the same standard of estimation is being adhered to.

In the *Annual Report of the Department of Agriculture, N.Z.*, for 1931–32, Hopkirk gives the following results of actual cell counts which were made on series of milks which had been assessed by the above method. They are as follows:

COUNTS MADE ON GRAVITY CREAM AFTER STANDING TWO HOURS AT ROOM TEMPERATURE.

0 per field, diameter 0.12 mm., or by Breed method, 0 per c.c. of cream.

1 up to 0.5 per field, diameter 0.12 mm., or by Breed method, up to ½ million per c.c. of cream.

2 up to 1.5 per field, diameter 0.12 mm., or by Breed method, up to 1¼ million per c.c. of cream.

3 up to 6 per field, diameter 0.12 mm., or by Breed method, up to 5 million per c.c. of cream.

4 up to 15 per field, diameter 0.12 mm., or by Breed method, up to 12 million per c.c. of cream.

5 up to 40 per field, diameter 0.12 mm., or by Breed method, up to 36 million per c.c. of cream.

6 over 40 per field, diameter 0.12 mm., or by Breed method, over 36 million per c.c. of cream.

Clumping of cells in " 1 " or " 2 " places the milk in " 3," and deposits in " 4 " or any sample places the milk in " 5 " or " 6 " irrespective of count. The cell assessment depends on the rise of cream, and if the " 6 " sample shows no cream layer, error may result, but a deposit will be noted."

Collection of Samples of Milk.—The teats are first wiped thoroughly, especially over the orifice of the teat canal, with methylated spirit. The first three jets of the foremilk are discarded, and the sample thereafter drawn into sterile test tubes. Samples are collected in the evening and placed in the refrigerator till the following morning, by which time ample cream has risen by gravity for the cultural work.

Discussion of the Results of the Experiment.

The experiment was actually commenced on 27.8.30, when the cow was inoculated into the mammary vein with 5 c.c. of a heavy suspension of *Br. abortus* in normal saline. The strains of abortus used for the injection were two which had been insolated about six weeks previously from aborted fœtal stomachs. Full details are given in the tables appended, and the main features will be discussed

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in general here. Increased cells were noted on the day following the injection, and, with slight fluctuations, showed a very gradual increase till at 1.12.30 there was a well marked low-grade mammitis in each quarter. Serum agglutination tests were negative the day following the injection, but markedly positive by the twelfth day. The reaction remained positive from then onwards without much fluctuation in the titre.

Although *Br. abortus* first appeared in the milk on the fifteenth day, and has been found almost consistently since that time, *the whey agglutination tests have been consistently negative*, and this result by the rapid method has frequently been confirmed by the tube dilution technique. In view of the absence of whey agglutinins, it was decided to inoculate one-quarter *via* the teat canal with a heat-killed suspension of the *Br. abortus* organism. Our object was to discover whether agglutin production in that quarter would follow the more acute mastitis which the inoculation would cause, and also whether the infection of the killed organism would lead to a local immunity and disappearance of the organisms from the milk of that quarter. The right hind quarter was chosen, and on 4.12.30 there was injected *via* the teat canal, with every possible precaution as to asepsis, 4 c.c. of a normal saline suspension of *Br. abortus* killed by heating to 80° C. The strain used was isolated during the previous week from this same quarter. A milk sample taken at the time the injection was made was graded 4 by cream-smear examination. In appearance the sample showed a rather thick cream line, with the underlying milk very slightly "off colour." 5.12.30: the sample had a heavy deposit of cells and opaque-yellow supernatant fluid. The cell deposit was composed of polynuclear leucocytes and some epithelial cells, but no organisms were detected in the smears. Whey agglutinins still absent. 6.12.30: condition unchanged. 8.12.30: appearance unchanged, but cultures showed a heavy pure growth of alpha hæmolytic streptococci.

It will be noted from the appended tables that the inoculation of killed *Br. abortus* did not evoke the presence of whey agglutinins, neither had it any notable effect on the actual abortus infection in the quarter. As to the appearance of streptococcal mammitis, the obvious view is that infection was accidentally introduced at the time of injection, or else that streptococci were lying dormant in the quarter all the time. The latter is scarcely likely, as, had it been the case, an occasional colony would have been noted in at any rate some of the many blood agar cultures made during the previous four months. The possibility of the former view being correct is quite admitted; but as having a possibly important bearing on the whole question of mastitis, we would like to record that not only were all precautions taken to avoid this contingency, but that while we have on many occasions made inoculations into the teat canal in a similar manner, an unexpected streptococcal infection has only occurred on two occasions, and on each of these it followed the inoculation by my colleague, Mr. C. S. M. Hopkirk, B.V.Sc., of *Br. abortus* into a quarter that immediately before the experiment had been shown culturally to be free from streptococci. As will be seen in the appended

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tables, the udder flora was not noticeably altered by the experiment, except for the appearance of *Br. abortus* and the occurrence of streptococci as indicated above.

The cow calved again in September, 1931. Unfortunately it was not known that she had calved till nearly a week later, so that the opportunity of examining the placenta for evidence of intra-uterine *abortus* infection was lost. The calf,

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TABLE I.—RESULTS OF CREAM SMEAR EXAMINATION AND AGGLUTINATION TESTS.

	Cream Smear Cell Content				Whey agglutinins				Serum agglutinins			
Date	R.F.	L.F.	R.H.	L.H.	R.F.	L.F.	R.H.	L.H.				Remarks
19.8.30	0	0	0	0	...		...		...	...		
27	0	0	0	0	Negative all quarters				Negative			Experiment began
28	0	1	0	0	...		...			,,		
30	1	1	1	2	...		...		...	...		
31	1	1	1	2	...		...		...	...		
1.9.30	1	1	1	1	...		...		...	...		
2	0	1	1	1	...		...		...	...		
3	1	1	1	1	...		...		...	...		
4	1	1	1	1	...		...		...	...		
5	0	1	1	1	...		...		...	...		
6	0	1	1	1	...		...		...	...		
8	0	1	2	1	Negative all quarters				Complete at 1/100			
9	0	1	3	1	...		...		...	...		
11	0	1	2	0	Negative all quarters				...	...		
12	0	1	1	1	...		...		...	...		
15	0	1	2	1	...		...		...	...		
17	0	2	2	2	Negative all quarters				...	...		
20	0	2	3	1	...		...		...	...		
22	0	1	1	1	Negative all quarters				...	...		
24	0	2	1	1	...		...		...	...		
29	0	1	1	2	,,	,,	,,		...	...		
7.10.30	0	1	1	1	,,	,,	,,		Complete at 1/200			
14	0	2	2	1	,,	,,	,,		,,	,,	,,	
21	2	2	3	2	,,	,,	,,		,,	,,	,,	
28	2	4	3	1	,,	,,	,,		...	...		
4.11.30	3	3	4	3	,,	,,	,,		Incomplete at 1/200			
10	1	2	3	2	,,	,,	,,		,,	,,	,,	
17	2	2	3	4	,,	,,	,,		,,	,,	,,	
24	1	2	4	3	,,	,,	,,		Incomplete at 1/100			
1.12.30	4	2	4	3	,,	,,	,,		Incomplete at 1/200			Heat killed abortus culture *via* R.H. teat canal 4.12.30
8	2	3	6	4	,,	,,	,,		,,	,,	,,	
15	3	3	5	3	,,	,,	,,		Incomplete at 1/400			
22	2	3	5	4	,,	,,	,,		Incomplete at 1/200			
30	1	2	6	2	,,	,,	,,		,,	,,	,,	
5.1.31	2	3	5	3	,,	,,	,,		Incomplete at 1/400			
12	3	4	5	4	,,	,,	,,		Incomplete at 1/800			
19	3	4	5	3	,,	,,	,,		,,	,,	,,	
26	2	4	5	4	,,	,,	,,		,,	,,	,,	
2.2.31	3	3	5	3	,,	,,	,,		,,	,,	,,	
10.3.31	...	...	...	...	...		...		...	...		Cow dry

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however, was normal, and carried for the full period. A monthly examination of her milk was made throughout that lactation period, and without giving full details, the results may be summarised as follows: Streptococci were no longer to be found in the right hind quarter. *Br. abortus* had disappeared from the left fore quarter, but were found consistently in the other three. Cream smears were generally classified as 0, though occasionally one-quarter or another was graded

TABLE II.—RESULTS OF CULTURAL EXAMINATIONS.

	Blood Agar Plates				*Br. Abortus* Cultures			
Date	R.F.	L.F.	R.H.	L.H.	R.F.	L.F.	R.H.	L.H.
27.8.30	40M	100M	50M	100M	0	0	0	0
29					0	0	0	0
1.9.30					0	0	0	0
4.9.30	Not cultured		... ...	... ...	0	0	0	0
8					0	0	0	0
11					0	1	2	40
15	10M	6M	10M	2M	0	1	70	10
22					0	0	1	1
29					Plates contaminated and overgrown			
7.10.30					0	0	0	0
14	Not cultured		... ...	... ...	0	0	0	0
21					0	0	0	0
28					0	0	1	0
4.11.30					3	1	7	20
10					20	30	200	80
17	90M	15M	35M	75M	6	3	70	15
24	15M	4M	2M	0	1	1	20	50
1.12.30	25M	5M	0	15M	4	9	30	60
4.12.30	Heat killed abortus culture inoculated *via* teat canal into R.H. quarter							
8	10M	3M	600A.S.	1M	7	1	3	25
15	5M	4M	800A.S. 25M	10M	3	1	5	3
22	0	10M	800A.S.	3M	6	10	15	60
30	0	2M	400A.S. 7M	3M	11	30	0	50
5.1.31	3M	10M	1000A.S.	0	3	8	4	45
12	5M	20M	1000A.S.	10M	20	8	0	120
19	0	0	1000A.S.	6M	0	5	1	60
26	2M	8M	1000A.S. 40M	10M	25	35	15	115
2.2.31	2M	3M	1000A.S. 6M	6M	15	20	4	60
10.3.31	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry

NOTE.—" M " in the table represents the common cocci found in milk. It does not include streptococci. " A.S."=alpha hæmolytic streptococci. The figures in all cases represent number of colonies from 0.1 c.c. gravity cream. Figures exceeding 10 have been given to the nearest 5, and those exceeding 200 to the nearest 100.

as 2. No higher assessment occurred, and the milk may be regarded as normal from that point of view. The udder flora, apart from *Br. abortus* in the three quarters, was comparable in number and species to that found before the experiment began.

The cow was slaughtered towards the end of this lactation period, and her udder was carefully examined. It was quite flaccid and of normal texture throughout. The supramammary lymphatic glands were normal in appearance, and yielded no *Br. abortus* on culture. Examination of sections from each quarter showed very occasional small aggregations of lymphocytes and polymorphonuclear leuco-

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cytes in the interacinous tissue. These could be found in each of the four quarters, but no organisms could be found in association with them by any of the usual methods of staining.

This case has been given in considerable detail because it demonstrates certain points very clearly, *viz.*: (1) A cow with a strongly positive serum and yielding *Br. abortus* from all four quarters may yet show no agglutinins in the whey. (2) *Br. abortus* can cause a low-grade mammitis on becoming established in the udder, and this can continue for some months. (3) Subsequently the udder may cease to react to its presence, and the inflammation subside entirely, although *Br. abortus* is still being shed in the milk. (4) The udder may pass through such a phase as the above without its normal flora being materially changed during the course of it. (5) It is very possible that *Br. abortus* infection may be one, among many possible factors, capable of paving the way for streptococcal mammitis.

STERILITY IN THE COW: SOME OBSERVATIONS ON CAUSES OF THE CONDITION MOST FREQUENTLY ENCOUNTERED IN THE PRACTICE OF VETERINARY MEDICINE.

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Introduction.

THE subject of this thesis is of ever-increasing economic importance in this and in other countries. Although a considerable amount of the research work carried out by Albrechtsen, Williams, Nielsen and others has added to our knowledge of the various conditions associated with or causing either sterility or delayed conception in the bovine female, it has to be admitted that the various opinions on these conditions and the exact rôle played by them in producing sterility are by no means universally accepted even by authorities of international reputation. Three examples of this diversity of opinion may be given: (1) The connection between contagious abortion and sterility; (2) the significance of nodular venereal disease, or, as it is commonly called in this country, "infectious vaginitis," in herds in which sterility or delayed conception is common; (3) as to whether the varying forms of endometritis are a result or an actual cause of sterility.

These examples will be discussed later. I am approaching the subject from the standpoint of a general practitioner, as I have encountered it in the course of the practice of veterinary medicine, and I shall, where and when found necessary, refer to the views of others and to the particular condition under discussion as seen in other countries. These references must of necessity add to the bulk of the thesis, but their exclusion might cause the subject to be regarded as incom-

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plete. At the same time I shall give my own opinion, and state the lines of treatment which I have found by practical experience to give the best results.

Definition of the term " Sterility."

Sterility can be shortly described as " the absence of fertility." It has been defined as " the inability of a female to bring forth living young," but this latter definition is not logical for the following reasons: (1) The female may abort or go to full term, and give birth to a dead fœtus. To classify such a female as sterile, therefore, would be absurd, as she has produced evidence of having been fertilised. (2) Reproduction depends as much upon the normal sexual activity of the male as of the female; sterility is, therefore, not due in all cases to the female, although the conditions which tend to produce it are much more common in the female than in the male. The essential factor in reproduction is the union of a normal spermatozoon from the male with a healthy ovum of the female. For this union to take place there is necessary not only the production of normal spermatozoa in the testicle of the male, but also the ability of the male to transfer them to the genital passages of the female. The female on her part must not only produce healthy ova, but her genital passages must offer unimpeded passage to both ova and spermatozoa. Failure of either in respect of any of these conditions will constitute sterility.

Folmer Nielson,[1] in defining sterility in the bovine female, is much clearer: " Sterility in this connection I define merely as a deficient faculty, at any rate at the given moment of service, of the female to become pregnant and to preserve and continue its pregnancy until the latter is either capable of being diagnosed by rectal palpation or until an interruption of the pregnancy will set in as an observable abortion." Summing up, sterility can be generally described as the inability of an animal to reproduce its own species, and this inability may be permanent or temporary, and due to various causes.

Classification of Sterility.

Two types of sterility are generally recognised: absolute and relative. The former implies persistent failure to conceive, the latter failure to carry pregnancy to a successful termination. Absolute sterility is the consequence of a failure affecting the earliest stages of the reproductive processes: either fertilisation does not occur, or the fertilised ovum fails to make good its implantation and perishes at once. Non-fertilisation is probably due to spermatozoa and oocytes not being brought into contact with one another. Relative sterility is due to some condition (anatomical, functional or inflammatory) which can be overcome.

Quinlan[2] has well summarised the causes which may interfere with fertility as follows: (1) The spermatozoa or the ova may be destroyed by exudates from an inflammatory lesion and the development of spermalysin or spermatoxin. This may take place in the Fallopian tubes, uterus, cervix, or vagina. (2) The ovum and spermatozoa may be prevented from coming together in cases of abnormalities in the Fallopian tubes, uterus, cervix, or vagina. (3) The fertilised

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ovum may be destroyed by bacterial toxins, or there may be death from malnutrition as a result of failure of the developing embryonic envelopes to become embedded in the degenerated mucosa of the cotyledons of the chronic metritic uterus. (4) A static condition of the ovaries resulting in failure to ovulate in functional sterility: cystic degeneration of the Graafian follicle or corpus luteum, and persistent corpus luteum. (5) Silent heat which occasionally occurs in cows and heifers, in which œstral symptoms do not occur, although ovulation takes place. (6) Deformities of the genital tract which prevent normal coitus. (7) Arrest in the development of the female genital tract such as occurs in the so-called "free-martins." These causes will be described under those diseases in which they occur. Some are comparatively rare, whilst others are a frequent cause of the condition under discussion.

Preliminary Steps to be taken in investigating Cases of Sterility.

In cases referred for professional advice and possible rectification, it will be found that it is essential to obtain information upon the following factors relating to the animal on which advice is being sought: (1) A history of the previous pregnancies, ascertaining if these were to full term, and if the calf was born alive and to all intent and purposes remained normal and healthy to the time of weaning. (2) Any history of repeated services since the last pregnancy and preceding it. If œstrum is regular or irregular. (3) If any retention of the placental membranes or abnormal or persisting uterine discharge followed the last parturition, and if assistance was necessary either at the parturition or for placental removal. (4) If a blood test has been made at any time, and, if so, with what result, and if at any time she has received anti-abortion vaccine. (5) Her milk yield per diem; the number of milkings per diem; was her calf taken away at, or soon after, birth, or allowed to remain with her for a few days? (6) Her present diet, and, where possible, the nature of the subsoil on which grazing takes place or from which the hay is obtained. (7) Where parturition takes place, *i.e.* in calving boxes, lean-to sheds, in the open, or in the byre, and what disinfection measures, if any, are adopted. (8) General information as to the fertility of the herd. Under this heading the following inquiries are included: (*a*) Whether abortions have occurred in the herd, and, if so, the result of blood tests, and if any protective inoculation has been carried out; (*b*) the existence now, or at any previous time, of vaginitis or observable genital disease, or any indication of such (*e.g.*, retained placentæ); (*c*) the number of bulls in the herd; the number of cows allotted to each per annum; if their use is confined to the herd; and if they have good "stockgetting" figures. (9) A mental note is made of the byre in which the cow is kept, at the same time ascertaining if the cattle lie in during the winter months, or if throughout the year they only come in for milking.

In the case of pedigree herds, where careful records are kept, an answer to the majority of these questions is not a difficult matter, and when possible it is as well to inquire into the fertility or otherwise of the dam of the female under investigation. Difficulty will be experienced in those cases where the animal

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has been bought in the open market, or from a dealer, and when no breeding history prior to purchase is possible. In these cases, however, much can be gained from her subsequent history as regards the manifestation of œstrus. These preliminary inquiries are invaluable, and should be made before any attempt at examining the cow. Very often it will be found that a fairly accurate idea as to the condition responsible for the sterility can be formed from them, *e.g.*, if the cow has been in irregular œstrus, the ovaries are not functioning normally, and the sterility may be due to cystic disease; if, on the other hand, œstrus has been regular, then the condition will in all probability be found in the uterus or genital tract, as it is obvious that, if the history is correct, the ovaries are normal at present.

Examination of the Sterile Bovine Female.

The preliminary investigation into her breeding history having been completed, proceed to examine the animal. Rectal examination should precede vaginal, in case unsuspected pregnancy exists. This is a contingency that must always be guarded against. The arm, having been well lubricated, is inserted into the rectum, and the ovaries, Fallopian tubes, broad ligaments, uterus, and cervix examined by palpation, and any departure from the normal is carefully noted. It may be emphasised that the only safe and sure diagnosis of pregnancy in the bovine female is from rectal palpation of the underlying uterus. If pregnancy can be definitely dismissed, the cervix can be secured by means of a suitable pair of vulsellum forceps and retracted towards the vulva. This is not always necessary in rectal examination, although it will be found that if this is done the examination is often much more satisfactory and complete; and successfully to examine the ovaries and Fallopian tubes, especially if the uterus is endometritic and as a result projects beyond the pelvic girdle, this will be found absolutely essential. As soon as the rectal examination has been completed, the vulvar lips are parted with the fingers, and evidence of vaginitis is looked for. A speculum is then lightly lubricated with some oily preparation (soap is not advisable, as it tends to " mask " any discharge that may be present in the vagina) and inserted, and an examination made of the vaginal walls, cervix, and external os. If there is any suspicious discharge present this is scooped up in the bottom blade of the speculum and brought out and examined. If deemed necessary the litmus reaction of the vaginal and cervical mucus should be ascertained; it has been found that some heifers have a pronounced acid reaction in their cervical mucus. The examination being now completed, the condition found is treated accordingly. The most common causes of sterility will now be described in a logical sequence, starting with those conditions affecting the ovaries, then proceeding to the Fallopian tubes and uterus, and finally the vagina.

Sterility arising from Diseases of the Ovaries (including Ovarian Deficiencies).

As will be shown later, ovarian disease or deficiency is rarely a primary cause of sterility. The following classification may now be given: (1) Functionless

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ovaries ; (2) congenital hormonal deficiency in adipose and lethargic animals due to a sluggish metabolism ; (3) acquired hormonal defects, such as excess of work, debility, and so on ; (4) pathological changes of the ovaries, such as :

(i) *Tumours of the Ovary.*—These are rare in veterinary practice.

(ii) *Diseases of the Ovary.*—These may be tuberculous or due to a perimetritis.

(iii) *Inflammation of the Ovary.*—This is over-estimated as a cause of sterility, and for practical purposes need not be considered in veterinary work. It is uncommon, but may arise from the act of crushing the corpus luteum, or from careless rectal manipulation of the ovary. It is usually due to severe endometritis.

(iv) *Cystic Degeneration of the Ovary.*—This is a secondary infection resulting from an inflammation of the uterus, and in my opinion due to a chemical toxæmia. The reasons for this belief are : (*a*) Proof of the existence of chronic endometritis in an affected subject ; (*b*) if common in a herd, one finds many cases of abortion, or retention of the placental membranes ; (*c*) it occurs in animals which are known to have suffered from chronic endometritis long before cystic degeneration is discovered.

Irregularities in the Œstral Rhythm.—The normal interval between the heat periods in cattle is usually said to be three weeks, but in reality there is considerable variation, and the interval may be shortened, inordinately increased, or absent for a considerable period. After parturition œstrum usually occurs again in about thirty to sixty days time, and in most herds it will be found that on an average the period is usually over thirty but under sixty days. So far as can be judged clinically, the only guide that the ovary is functioning normally, and thereby formulating a functioning ovum, is the exhibition of œstrus at the proper interval after parturition, and subsequently at an interval of 19, 20, or 21 days. The interval or " resting period " between the heats may be as short as 16 days, or as long as 24 days, and the average length may be stated to be 19½ days. Heifers with a regular œstrus cycle prior to service frequently exhibit irregularities and sterility subsequent to copulation. In the absence of œstrus for nine or twelve weeks after copulation it seems feasible to assume that there has been a condition which for want of a better term may be called " pseudo-pregnancy," or infection with a gram-negative coccus, or a filtrable virus may have occurred at coitus. The manifestation of œstrus is a psychological phenomenon due to a physico-chemical condition of the blood plasma, the ovaries, and the uterus. The intensity of its manifestation varies, and it may be totally absent, last a few hours, or be normal, or continuously present. In a like manner, œstrus itself may have a varying diœstrous period of a few hours, days, weeks, or months, or which may be continuous. On the average, œstrus lasts about sixteen hours in heifers, and nineteen hours in cows. In the winter a heat period may only last six hours, as against sixteen or more (up to thirty) in the summer. It can be quite easily understood that a short period occurring in the night is often overlooked by the stockman.

Ætiology.—The two main causes leading to disturbance of the ovarian function may be due to :

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(1) *Pathological Changes.*—As a general rule these do not occur independently, but are usually secondary to and concurrent with changes of a pathological nature existing in the Fallopian tubes, uterus, or in both. In the case of the disease known as " Nymphomania," however, it seems highly probably that the primary lesion is in the ovary, and is brought about by endocrine disturbance, and the lesions in the uterus and the Fallopian tubes are of a secondary nature.

(2) *Functional Disturbances.*—There appears to be but little doubt but that the ovary is under the direct influence of the anterior pituitary, and, as will be pointed out when discussing nymphomania, it seems hardly correct to state that it dominates the ovary. Parkes, in his book on " The Internal Secretions of the Ovary " (Longman), has given the name of " prolan " to the internal secretion of the anterior pituitary, and it seems that this secretion picks out the mesenchymatous tissue of the ovary, and causes it to secrete " œstrin." When œstrin gets into the blood stream from the ovary it acts upon the genital tract (uterus, vagina, vulva), and brings about œstrus, which is produced as a clinical manifestation. The ovaries are but a part, but a very important part, of the entire endocrine system, and they will function normally, and thus induce and maintain normal genital development and activity only so long as this system persists in a state of perfect equilibrium effected by inter-glandular reciprocity and chemical correlation of all its members. Ovarian function is therefore very likely to be interfered with whenever this balance becomes disturbed through either hypofunction or hyperfunction of an individual gland.

In this country Pugh[3] has drawn attention to the pathological changes observed in the thyroid gland in sterile cattle, and the relationship of this gland to the ovaries appears to be especially intimate, so much so that normal ovarian development and normal ovarian function are scarcely possible if thyroid secretion is not normal. The administration of thyroid preparations has indeed been found to be very useful in some cases of bovine sterility, and it is of interest to note that it is probably the only glandular product which when given by the mouth is of any therapeutic value in the larger domesticated animals. Sterility in the case of the obese woman is stated to be nearly always due to otherwise unnoticed thyroid deficiency, and it would appear quite feasible to suppose that the same deficiency may very well be the cause of the sterility so often encountered in show cattle which have been grown and kept in an exceptionally fat condition.

There are three structures in the ovary which must be considered in relation to its incretory activity, namely, the follicular apparatus, the corpus luteum, and the so-called interstitial gland. The Graafian follicle containing the ovum is obviously the most important of the constituents. It not only performs the double function of supplying the mature ovum and a definite endocrine substance in its liquid contents, but as a matter of fact it also gives origin to two new structures endowed with endocrine activity, *i.e.*, the corpus luteum and the interstitial gland. The corpus luteum is the end-product of the completed ovulation cycle, and the interstitial gland supposedly represents the atretic follicle, where maturation has not been complete.

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Symptoms.—In cases of irregularities in the œstral rhythm, the cow may present one of the following characteristics: (1) She may be more or less constantly in season, and exhibit marked desire for sexual intercourse; in short, a nymphomaniac. (2) Œstrus may be manifested under or above the normal recognised period, but nymphomaniac symptoms are not shown. (3) Œstrus may be absent for an indefinite period, and then re-occur. (4) Œstrus may be very slight, and last only a few hours. (5) Œstrus may be totally absent. These cases will now be dealt with in the order given.

REFERENCES.

1, 5, 6, 7. Folmer Nielsen: *National Veterinary Medical Association Proceedings.* Dublin, 1926.
2. Quinlan: *Fifteenth Annual Report of the Director of Veterinary Services.* South Africa, 1929.
3. Pugh: "The Assumption of Male Characters by the Cow," THE VETERINARY JOURNAL, Vol. 82, 557–563.
4. Pugh: *Veterinary Record*, Vol. 4, 1924.

(*To be continued.*)

THE ERADICATION OF TUBERCULOSIS FROM DAIRY CATTLE.

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IT is well known to all veterinary surgeons and to a large proportion of farmers that tuberculosis is the cause of serious losses in the cattle industry of this country, particularly in dairy herds, and that the presence of this disease amongst dairy stock constitutes a menace to the health of children and is a hindrance to the sale of fresh milk. It follows, therefore, that the problem of the eradication of this disease from our cattle herds deserves the most serious attention of stock owners and of all engaged in the production and distribution of milk.

Recent surveys of the extent to which tuberculosis affects dairy cattle are more or less in agreement that the proportion of cows in dairy herds which will react to the tuberculin tests ranges from less than 10 per cent. to over 80 per cent., according to the location of the farms and the conditions of management and herd maintenance. The average is estimated at 40 per cent. These figures afford a measure of the magnitude of the problem, and when it is remembered that the disease also affects pigs it may seem that eradication in the true meaning of the word is not a practicable proposition. A moment's thought, however, will, I hope, lead to the conclusion that a fatalistic acceptance of the present position is a mental attitude which cannot be tolerated. Breeders will realise that constructive and systematic measures to lessen the incidence of tuberculosis must be undertaken if Great Britain is to maintain its reputation as the "World's Stud Farm," and the dairy farmers must understand that the continued presence of "open" or infective cases, and particularly cows with infected udders, leading to the occasional production of milk containing live tubercle bacilli, lessens public confidence in the milk supply and is a very definite hindrance to an increase in the consumption of milk.

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The measures which have been taken during recent years by the Ministry of Agriculture and the Ministry of Health have been directed towards lessening the incidence of the disease by discovering and dealing with the most dangerous cases, but it is now common knowledge that action under the Tuberculosis Order, 1925, is taken too late to have any value as a means of eradication, and that action taken under the Milk and Dairies Acts, to discover and destroy cows yielding tuberculous milk, often cannot be effective because of the extreme difficulty in finding the affected animal. The Tuberculosis Order must be amplified, and the inspection of herds carried out generally and systematically before any real progress can be made towards eradication. The Milk (Special Designations) Order, although unsatisfactory in the nomenclature of the grades of milk, has been helpful by providing the only official recognition at present available in this country for herds which have been tuberculin-tested, and contain no reactors.

The need for more specific and organised measures to lessen the prevalence of tuberculosis in our cattle herds has been recognised for many years, and in 1919 the " Astor " Committee recommended that a scheme to assist farmers to form tubercle-free herds should be introduced, and that such a scheme should provide for: (1) The manufacture, distribution and use of tuberculin to be controlled by a central authority. (2) The method adopted in the carrying out and the interpretation of the tuberculin test to be standardised. (3) Facilities to be provided out of public funds for free tuberculin testing, provided that the farmer is willing to comply with the necessary conditions laid down for freeing his herd of reactors. A herd which has complied with the specified conditions would be recognised as tubercle-free, and a certificate given to that effect. The herd would be subject to periodical retesting.

In the interval since 1919 no official scheme has been introduced. Some progress has been made by the Ministry of Health in connection with the issue of licences to Certified and Grade A (T.T.) herds, and by the introduction of the double intradermal test, but the need for control of tuberculin, standardisation of tuberculin tests and their interpretation, and the inauguration of an official register of tubercle-free herds is greater than ever.

In 1931 the National Veterinary Medical Association published a scheme for the eradication of bovine tuberculosis, based on a combination of the methods which have been developed in the United States and Canada and in Denmark. This scheme is no doubt well known to the readers of THE VETERINARY JOURNAL, and I need only say that in some quarters it met with a cold reception, and little progress has been made towards its adoption. In my opinion the scheme as published is more of an outline than a fully developed scheme, but as the administration and decision as to details must ultimately rest mainly in the hands of the Ministry of Agriculture, there is little to be gained at present by amplifying the suggestions regarding degree of segregation, formation of accredited areas, etc. It is more important that those sections of the scheme which deal with the first steps to be taken should be freely discussed so that a firm foundation may be

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laid for future progress. In any scheme of eradication it is first necessary to discover the reactors, and this involves the application of a tuberculin test. The scheme as drafted assumes that no difficulties will arise in this connection provided that only tuberculin of guaranteed potency is used, and that the test is carried out according to the manner to be laid down by the Ministry of Agriculture.

The experience of many farmers who have attempted to free their herds of reactors in order to obtain a licence from the Ministry of Health for the sale of Certified or Grade A (T.T.) milk, or for other reasons, indicates that difficulties will arise, and that the position is by no means so simple as the scheme assumes. Until a few years ago the test mainly used was the subcutaneous test, then the ophthalmic test was introduced in addition, and later, after careful research carried out by the Tuberculin Committee of the Medical Research Council, the double intradermal test was brought into practice; since July 1st, 1930, this test only has been accepted by the Ministry of Health in herds applying for the above-mentioned licences. I am aware there is evidence to show the greater all-round reliability of the double intradermal test, and it is certainly easier to carry out in practice, but there have been a considerable number of instances where a marked difference of opinion has occurred as to whether an animal was or was not a reactor; in several instances the opinion of a local practitioner has not been confirmed when the same animals were examined or retested by a veterinary surgeon appointed by the Ministry of Health. From time to time I study the veterinary press, and in the course of 1931 I was surprised to find that it was still considered necessary to have demonstrations of the technique and interpretation of the double intradermal test at branch meetings of the National Veterinary Medical Association.

I agree readily that the tuberculin tests (subcutaneous and double intradermal) have proved invaluable in the detection of infected animals and in the building-up of healthy non-reacting herds, but until much greater uniformity and reliability in interpretation can be obtained throughout the country, the confidence of farmers will not be gained sufficiently to warrant the introduction of a national scheme of eradication. The question whether the tuberculin testing required for any such scheme would not be more efficiently carried out by full-time veterinary officers engaged by county or other authorities, will also require consideration. The emphatic recommendations by the Milk Reorganisation Commission in favour of the appointment of whole-time veterinary officers by County and County Borough Councils may be expected to lead to a marked development of such a service, and in the near future it appears probable that the tuberculin testing of dairy herds for the production of Certified and Grade A (T.T.) milk will be mainly carried out by such officers. It is also reasonable to expect that such a procedure would lead to greater uniformity in testing methods and results.

When official or national schemes for the eradication of tuberculosis are under discussion the question of compensation for animals slaughtered by order always arises. If an animal has become so badly affected that it is obviously

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seriously ill, it is difficult to see why any compensation should be paid. In so far as such animals are a danger to human and animal health, a severe fine for failure to report them would seem a more suitable measure ; but when an animal which appears healthy and in good condition, judged by ordinary farming standards, is found to be in an infective condition or a reactor and is slaughtered, compensation in some form is only a matter of common justice. Also, since the operation of such a scheme will provide safer milk and meat for the population as a whole, it seems just that grants for compensation should come from the Government rather than from county authorities. The actual method of arriving at the amount of compensation to be paid can be settled without serious difficulty, but sufficient latitude must be allowed to deal fairly with valuable breeding stock. In my opinion, however, the payment of compensation for slaughtered reactors should be conditional on a definite effort being made by the owner to build up a tubercle-free herd.

In any scheme of eradication the farmer must also play his part. The State and the veterinary profession can take steps to secure reliable technique in the tuberculin test, and the State can contribute towards the cost of testing, compensation, and perhaps the provision of temporary accommodation for isolation purposes, and fencing for protective purposes ; but these measures will be useless unless the herd owner is prepared to give his whole-hearted co-operation. I consider the farmer must be prepared to separate reactors from non-reactors at once, and to keep them separate to the greatest degree possible under his own conditions, to carry out adequate measures of disinfection of premises which have been occupied by infected animals, and to take such precautions as may be necessary to prevent infection of non-reacting stock from contaminated water supplies, from manure (solid and liquid), from pigs, from stock on adjacent farms, and from purchased milk or dairy by-products. Also he must be prepared to rear his calves and young stock under healthy conditions, and to build up sound constitutions by adequate feeding. On some of these points, such as disinfection and protection from reinfection, even careful farmers are often in need of advice, and I can foresee a wide field of usefulness for the county veterinary officer in giving assistance on such points to farmers who are anxious to keep their herds free. It should also be possible for such officers to suggest to herd owners whose conditions of herd management and maintenance are suitable, to embark on an attempt to develop a tubercle-free herd.

I have already emphasised the need for a definite progressive policy towards eradication, but a consideration of the present conditions forces me to the conclusion that before a scheme on a national basis is introduced we must have amendment or amplification of the Tuberculosis Order to attain greater efficiency in the detection and disposal of " open " cases, we must have control of the manufacture, distribution and use of tuberculin by a central authority, the mode of application and interpretation of the tuberculin test must be made more uniform and reliable, and we must have a fuller understanding on the part of

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dairy farmers that the presence of tuberculosis in their herds is a real hindrance to the development of the sale of milk untreated by heat, and that under certain conditions, which fortunately are fairly common, herds can be freed from this disease, and kept free, at a moderate cost. When real progress has been made towards the attainment of the above conditions the foundation will be laid for the introduction of a national eradication scheme, proceeding from herds to " accredited " areas, and in course of time to all the cattle herds in the country.

THE VETERINARY INSPECTION OF DAIRY COWS IN ENGLAND AND WALES.

By D. S. RABAGLIATI, O.B.E., B.Sc. (Agric.), M.R.C.V.S.
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THE Milk Reorganisation Committee and the Council of Agriculture for England have recently issued independent reports on the question of our milk supply, and among other recommendations have strongly urged the necessity of a regular clinical examination of all cows producing milk for human consumption. Even the National Farmers' Union has of late made it known that this body is also in favour of such inspections by veterinary officers. It would thus appear to be justifiable to include some remarks about this branch of veterinary work in an issue of this journal allotted to cattle and their diseases.

The subject is by no means so simple as some would have us believe, for it raises numerous administrative and other difficulties, many of which are due to the dual or even multiple control under which our legislature has placed the supervision of the milk industry. Moreover, from the strictly professional standpoint the subject has now become so wide, and embraces so many conditions, that it has assumed a completely specialised branch of work under the more comprehensive term of Veterinary Public Health. The systematic inspection of cows is really in its infancy in England and Wales, although it has been carried out for many years in Scotland, and also in certain boroughs in England, but as far as the counties are concerned it was not done at all in England even so recently as six years ago.

The authorisation to inspect cattle is contained in Part IV of the Milk and Dairies Order of 1926, which states that : " Every County Council and County Borough Council shall cause to be made such inspections of cattle as may be necessary and proper for the purposes of the Act and of this Order." Then follows the now almost historic circular letter from the Ministry of Health, dated January 20th, 1927, in which the following words occur : " It is for each County Council to decide, according to the experience available in their area, what amount of further inspection is desirable. . . . Inspection conducted on purely routine lines may not in all cases be the best means of attaining the objects of the Act." It will thus be seen that the amount of inspections carried out—even if carried

out at all—depends upon the interpretation placed on the meaning of this part of the order by the local authorities concerned.

In the county boroughs where the administration of the whole of the Order devolves on the borough council, the matter is administratively simple, especially when all the duties involved are placed under the supervision of the veterinary officer, as is sometimes the case, but in the counties where the greater part of the Order is not under the control of the county authority at all, the position of the veterinary officer is much more delicate, and it is chiefly to the county officials that these notes apply.

With the exception of the four articles dealing with the health of the cattle, the whole of the Order, which comprises some thirty-three articles, is administered by the local sanitary authority, that is non-county borough, the urban or the rural district council, as the case may be. *As the number of sanitary authorities in an English county is often legion* (for instance in the West Riding of Yorkshire there are no less than 147 of these within the county administrative area), *and each authority interprets the Order in its own way, it follows that there can be no great uniformity in the construction of the cow-sheds or the manner in which milk is produced.* That this should be so is no doubt open to considerable criticism; and the simplification of control which one would suggest should be vested in county councils and county borough councils only, at least so far as producers are concerned, is greatly to be desired.

However, until such time as these changes are made, it behoves us as a profession to carry out the law as it stands, and to co-operate with and give assistance to those deputed to enforce it to the best of our ability. One of the first tasks of the county veterinary officer whose duty it is to arrange for and carry out the inspection of the cattle must be to get into touch with the various authorities in his area. No system of inspection can be a success without the whole-hearted support and co-operation of the local officials, and better still of the local councils too. This can only be done by the veterinary officer persuading them that the work is for the public good, and therefore their own good, and that he is there to help and advise them on the improvement of premises and methods of clean-milk production, just as much as for the purpose of detecting disease in the cattle. As each sanitary district has its own medical officer and sanitary inspector, and sometimes two or even more of the latter, it can be realised that the utmost tact is required to avoid "treading on anybody's toes." As it is the sanitary inspector who is responsible for the hygiene of milk production, I have found it an excellent plan to ask the local inspector to go round with the veterinary officer whenever possible. This does more than anything to prevent misunderstandings, and as it is often a great convenience to the local official to be taken round in the veterinary officer's car, the practice works admirably.

When each tour of inspection has been completed it is a sound plan to write a report to the council concerned setting out the number of farms visited, the cows examined, samples taken, tuberculous or otherwise diseased cows

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found on inspection, and then give a short report on the general conditions under which milk is produced in the district, and if thought desirable, a list of the unsatisfactory producers and premises. These methods, if tactfully carried out, go a long way to improve matters, and at the same time create an interest in the work in the district. As the county council has supervisory powers over the districts as regards the manner in which the Milk and Dairies Order is administered, it is advisable that the veterinary officer should report on these matters to the public health committee of the county council, for there is no other officer of the county with the same opportunity of judging. Although legally we have very inadequate powers, yet if the few we do possess are utilised to the best advantage, it is surprising what a moral influence can be exerted.

It is essential that the veterinary officer carrying out the routine cattle inspection should be appointed " an inspector " under the Diseases of Animals Acts, so that he can deal with any tuberculous cattle he finds under the provisions of the Tuberculosis Order. The only exception to this is in the case of a non-county borough which happens to be itself a local authority under the Diseases of Animals Acts. In this case it is the duty of the veterinary officer to report diseased or suspected cattle to the borough authority to be dealt with by the veterinary inspector of the borough concerned.

For the greatest value to be derived from the examination of cows, inspections should be at least quarterly, except perhaps in the case of the butter-producing farms, where most of the cattle kept are young, and half-yearly inspections may be quite adequate. In practice, however, the expense of quarterly inspections has in most cases been considered insuperable, and half-yearly visits are all that are aimed at in most county districts. In winter when the cattle are housed, surprise visits should be paid without notice, but in the summer, to avoid delays in collecting the cattle, which would make the work impracticable, it is necessary to notify farmers to have their cattle in the sheds ready for inspection at a given time. A little experience in the district will soon enable a time table to be made for each day, and it has always surprised the writer to find how willing the farmers are to have their cows ready for examination at the time asked for. While notification of intended visits is not to be desired for obvious reasons, there is no other way of carrying out the work during the summer months. It has often been said that inspections should be made at milking times, in which case notification is unnecessary. This is all very well when only a few farms are visited, but as one producer may milk at 2 p.m., while his neighbour may not do so till six, it is quite impossible to rely on this.

The number of milk samples taken depends largely on the type of cows examined, and also on the experience of the examiner, but it is a good rule for the veterinary officer to take a sample of milk from *any* quarter of a cow's udder that is in any way suspicious of tuberculosis or other disease. *Too much insistence cannot be put on a search being made on the walls, stall divisions and mangers in front of the cows for sputum, especially in the case of animals which do not appear*

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to be thriving too well. It is really amazing to find how many cows are coughing up mucus, and it is by no means uncommon to find some, to all outward appearances perfectly normal, to be coughing up tubercle bacilli. Such cows are of the greatest danger to others in the same shed, and unless these animals are eliminated, much of the benefits of routine inspection is lost.

Each veterinary officer must be supplied with a centrifuge, electric if possible (although a water one works remarkably well), microscope, oil-immersion lens, mechanical stage, slides, stains, and so on. To show the number of specimens that it may be necessary to take and examine, the following are the samples taken by four members of the West Riding staff in a little less than one complete year, and the results of their examination.

SAMPLES EXAMINED MICROSCOPICALLY.

		Tubercle Bacilli found microscopically.	Negative.
Milk	1152	252	900
Sputum	632	192	440

Milk microscopically negative submitted to the biological test: 574. Positive, 44; negative, 530.

I look upon it as very necessary that each veterinary officer should himself examine the samples he collects, for with the picture of the animal in his mind he is much more competent and likely to arrive at a correct diagnosis than is a man who has not seen the animal from which the sample was obtained. Although the preparation and examination of the samples taken on his daily round must often be done after official hours, it is well worth while, and is the only way of making up one's mind as to which milks should be sent forward to the laboratory for the biological test. The vast majority of tuberculous milks should be diagnosed microscopically, and I do not think that at least 85 or even 90 per cent. of successes is too high a figure for an experienced man to attain. The milk samples negative to the microscope may or may not be worth sending for a biological test. In practice it will be found that it is unnecessary to send the majority of the negative milks further, and it is not always easy to make up one's mind; but the clinical condition of the cow, the type of induration of the udder, and the character of the sediment and of the cell content of the milk must be the deciding factors. Only those with reasonable grounds for suspicion should be sent, otherwise the number becomes too great, and the expense prohibitive. If the veterinary staff do not themselves carry out the biological tests, it is a great help if they have direct access to the laboratory for consultative purposes.

One of the greatest objections that the farmers have put forward against the examination of their cattle is the prohibition often placed on the use of milk from cows from which samples have been taken, especially if, after the lapse of six weeks they are told that the milk is all right. If, as a result of a microscopic examination this can be avoided, or at least greatly minimised, it goes a long way to gain the tolerance if not even the active support of the farmer. *At a recent*

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meeting of the Farmers' Club in London, a leading agriculturist stated that the National Farmers' Union had circularised its branches, and that they found in districts where veterinary inspection is now carried out the farmers would not like to go back to the days without it, even although there might have been some antagonism in the beginning. This is a most satisfactory feature, and shows that the farmers now realise the benefits they derive from having their cattle examined. It also indicates that those members of our profession who are carrying out this work are using tact and discretion, and have gone about their duties in a reasonable and common-sense way. The improvement in the milk supply and the lessening of the risk of tuberculous milk being put on the market as the result of regular inspections are becoming more and more appreciated. In my opinion this work is opening up the eyes of the stock owner to the often high incidence of tuberculosis in his herd which previously he never realised, and is the surest and most certain way of leading up to some general scheme of tuberculosis eradication being put into force.

There are still those who look upon the clinical inspection of cows as of little or no value, and some even go the length of saying that it is a waste of money; but such views usually indicate inadequate knowledge of its possibilities. It is not claimed even by its staunchest supporters that it will eradicate tuberculosis; but if it were carried out conscientiously *all over the country* instead of in isolated areas as at present, it would greatly lessen its incidence. Farmers who are constantly having cattle condemned take much more care in their purchases, and sooner or later go in for a better class of stock. It is the rule to find that the diseased cattle are found year by year on very much the same premises. This may be due to infection, but probably more so to the type of cattle kept.

It is the writer's firm conviction that if regular quarterly visits were made to all milk-producing farms in the country by competent veterinary officers who could devote sufficient time to the work, the percentage of tuberculous milks on the market would be so reduced as to greatly lessen the present-day agitation in favour of pasteurisation.

THE INADEQUACY OF "BULK" SAMPLING AS A MEANS OF PROTECTING THE PUBLIC FROM THE DANGERS OF TUBERCLE INFECTION IN MILK.

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THERE is ample evidence within recent years of a definite quickening of the public conscience in regard to matters relating to health, and among the many subjects which have received special attention in this connection a wholesome raw milk supply is one of the greatest importance. The reasons for this are so obvious, and have been so oft repeated, that there is no need to mention them here. The greatest risk of disease to the milk-consuming

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public, especially children, is undoubtedly tuberculosis : it is the real skeleton in the dairy cupboard, and if milk could be produced free from tubercle infection at a price within the reach of all, an enormous and beneficial increase in its consumption would be the result.

The protection of the public from the dangers of tubercle-infected milk is an enormous subject, and in this short article I propose considering just one aspect of it, namely, the protection of the public by means of the collection of " bulk " samples of milk, and submitting them for biological examination for the presence of tubercle bacilli. I do not propose to discuss the laboratory aspect of the biological test for tubercle, but rather to deal simply with the question of " bulk " sampling as a means of detecting a cow or cows suffering from tuberculosis of the udder or passing tubercle bacilli in the milk on the farm where the milk was produced.

Under the terms of the Milk and Dairies (Consolidation) Act of 1915, a local authority has power to collect samples of milk for examination " at any time before it is delivered to the consumer." These samples, which are generally referred to as " bulk samples," are usually taken from milk churns at railway stations, milk depôts, retail dairy premises, etc. In large towns the great majority of the milk consumed by the inhabitants is produced outside the city boundary, and the only means that such a local authority has for its protection from the dangers of tubercle infection in such milk is by the collection of bulk samples for biological examination. When one of the samples is found tuberculous, the medical officer of health of that local authority must inform the medical officer of health of the county or county borough in which the milk was produced, and he arranges to have the herd concerned examined by a veterinary surgeon with a view to the detection of the cow responsible for the tubercle infection in the milk. As a large proportion of the public are consuming milk which is produced outside the area in which they reside, and their protection from tuberculous milk is by means of bulk sampling, it is well to consider whether such a procedure does in fact offer a reasonable means of protection. I submit with respect that the protection afforded is so slight that it is quite inadequate to meet the needs of the community, and I shall endeavour to show why. It is generally admitted that efficient and thorough routine veterinary inspection of the dairy herds would do a great deal to eliminate the dangerous tuberculous cow, but such a procedure is practised by so few counties, although the number has increased considerably within recent years, that it can only afford partial protection to a very limited number of towns. In the collection of bulk samples it is assumed that if a cow on the farm where the milk is produced is passing tubercle bacilli in her milk, their presence in the churn will be detected by means of the biological test ; and so it would if all cases were just as simple as the illustration, but all kinds of difficulties and complications arise in practice which detracts from the reliability of the procedure as an adequate means of protecting the public.

Some of the factors which complicate the bulk sampling of milk are as follows :
(1) There may only be the milk of a few cows in the herd in the churn sampled.

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(2) Churns are occasionally mixed, one farmer using churns which belong to another. (3) The churns may contain the milk of several producers. (4) The milk may have been pasteurised. (5) In the summer time particularly a number of churn samples cause premature death of the guinea-pigs before tuberculosis can be diagnosed. (6) The sample cannot contain any milk from the "dry" cows in the herd. (7) When milk is collected by motor from several small producers, and the person collecting the milk uses a measuring bucket, the milk of several producers may be infected with tubercle.

(1) Some persons who collect samples think that a sample from one churn is sufficient and satisfactory for the purpose. This is obviously not so, because the milk from a cow with a tuberculous udder may contaminate the whole milk from the herd, or it may not. Where the cooler, milking pails and churns are thoroughly sterilised after each time they are used, whether all the milk or only part of it contains tubercle bacilli, will depend on at what stage during the milking process the cow with the tuberculous udder is milked. If she is milked first the cooler will be contaminated when her milk is passed through it, and consequently all the milk which passes through it subsequently will become contaminated from that source. On the other hand, if she is milked last, the only milk which will contain tubercle bacilli is that in the last churn. Where a cooler is not used, the milking pail is usually responsible for the contamination of the bulk milk; but, again, only certain churns may be affected through this medium. The position is similar where a milking machine is used. It is, therefore, obvious that any churn sample submitted for biological examination should contain a portion of milk from each of the churns despatched by the same producer.

(2) Not uncommonly when a farmer visits the railway station to collect his empty churns, he finds that the number required may not have arrived, so he helps himself to any that happen to be there to make up the required number. In some districts this is quite a recognised custom, the practice of which very materially increases the difficulty of detecting the source of the tubercle bacilli in the milk. Not infrequently when "empties" are returned by motor lorry, the same difficulty arises.

(3) The milk of several producers may be in the same churn. This happens in the case of churns from milk depôts, etc., and where a farmer collects milk from his neighbours to augment his supply. When a churn sample of this description turns out tuberculous it is as a rule a matter of great difficulty, and in some cases an impossibility, to find out the particular herd responsible. Where the sample is from a milk depôt, the manager may be unable to give the names of the producers who had contributed to the churn sampled, and in order to find out which herd or herds supplied the tuberculous milk, it would be necessary to sample each individual herd which had supplied milk to the depôt at the time the churn sample was despatched. As the time required to carry out the biological test is about six weeks, a period of at least three months would elapse before the necessary testing had been completed, during which time the unfortunate con-

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sumer is receiving tuberculous milk until the cow responsible for the tubercle bacilli in the milk has been disposed of in accordance with the provisions of the Tuberculosis Order of 1925, or otherwise. In the case where a producer collects some milk from his neighbours to augment his own supply, the difficulties are not nearly so great, provided he is honest and volunteers the necessary information to that effect; but suppose his herd is examined, and no cow passing tubercle bacilli in her milk is detected, unless he informed the inspecting veterinarian of his practice of collecting milk from neighbours, the investigation into that particular sample would be written down as one where no source of the tubercle bacilli in the milk could be detected, while all the time the culprit may still be supplying tuberculous milk on a neighbouring farm.

(4) The milk in the churn may have been pasteurised, in which case, if the pasteurisation has been properly carried out, no live tubercle bacilli will be present.

(5) Churn samples, especially in the summer time, not infrequently cause premature death of the guinea-pigs before tuberculosis can be diagnosed. Much of the ordinary market milk is heavily contaminated with organisms derived from bovine fæces, dirt, etc., and when such milk is exposed in churns to the sun at railway stations and in motor vehicles, there must be an enormous increase of the organisms present in the milk, resulting in the premature death of a number of the guinea-pigs.

(6) It seems unnecessary to state that a churn sample cannot contain the milk of " dry " cows, but in considering the efficiency of the biological examination of bulk milk samples as a means of protecting the consumer, one must not forget that a " dry " cow may have a tuberculous udder, and as soon as she calves will be giving gallons of milk teeming with tubercle bacilli. In this connection I should like to say that on some milk-producing farms a certain number of cows are kept for rearing calves, and not infrequently the cows selected for this purpose are the ones which have diseased udders. It is one of the common methods of dealing with surplus milk on the farm, and as soon as a market can be obtained for such milk the calves are either bucket fed or sold, and the milk is included in the general supply. It is apparent that where there is a " dry " in-calf cow with a tuberculous udder, or a cow with a tuberculous udder suckling calves on a dairy farm at the time the churn sample is taken, the biological result may still be negative, and yet, within a few days of the taking of the sample, the cow may have calved, or the milk of the cow that was suckling the calves may be included in the general supply, which will now be heavily infected with tubercle. A very grave risk is run by the consumer in such cases, because as the responsible officials of the local authority have just sampled the milk and found it free from infection, a variable but usually considerable period will elapse before the milk from this farm is re-sampled.

(7) In this case, when milk is being collected from a number of " small " producers, the person collecting the milk usually measures the quantity collected in a measuring bucket and then pours it into a churn. If the first milk passed

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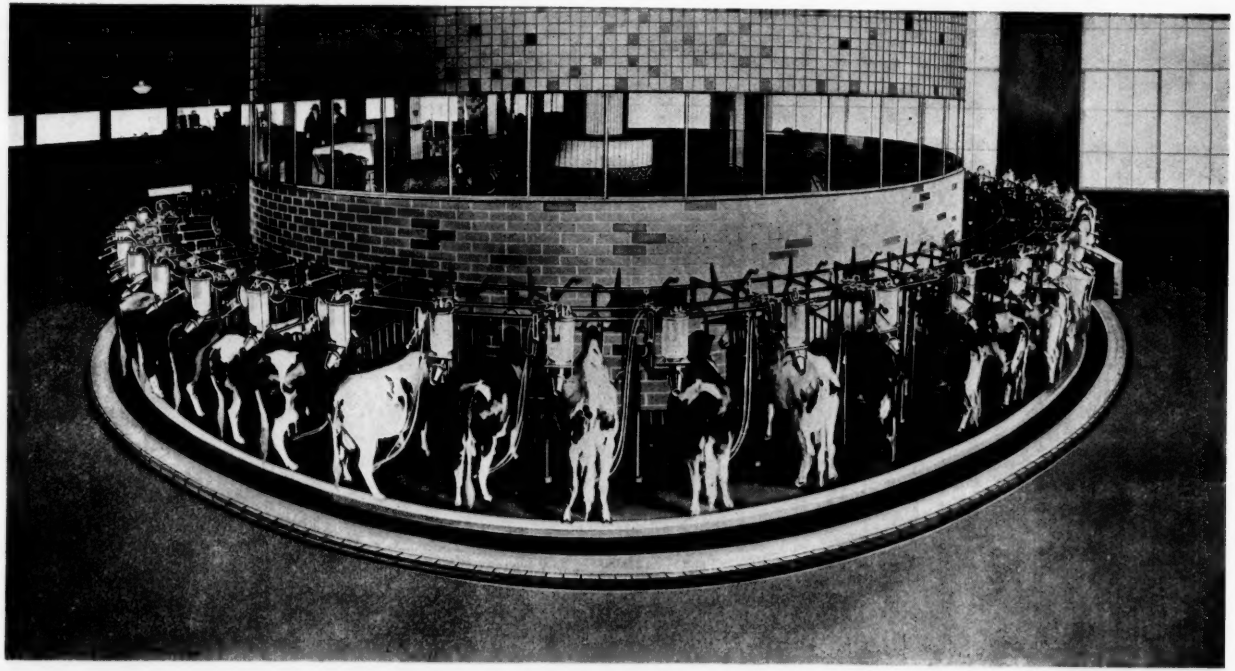

The Walker-Gordon Milking System. The Rotolactor.

(*Article on page* 183)

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through the measuring bucket is tuberculous, then all the subsequent milk measured will be contaminated. When the churns are delivered to the retail dairy premises, and one is found to contain tubercle bacilli as a result of a sample being returned tuberculous, the farm or farms from which the milk was obtained may or may not have a cow suffering from udder tuberculosis on the premises, because the infection in the churn may have come from the measuring bucket which had become infected by milk collected earlier from another farm.

If the truth of what has been said be admitted, then it is obvious that under present legislation the large county boroughs where so much milk is consumed that is produced outside the county borough boundary, no matter how rigorously the local authority carried out its powers, no really adequate means of protecting the consumer from the dangers of tubercle-infected raw milk exists. This should be, and I have no doubt is, a matter of the gravest concern to those responsible, and in the interests of the milk-consuming public in our large urban areas should be remedied without further delay.

MILKING MACHINES.

MILKING cows by machinery is now regarded as a conventional matter. After a long and somewhat tortuous history of development, the milking machine industry has reached a stage now when it holds a permanent position amongst the adjuncts of milk production. About 1860, the first attempts were made to milk cows mechanically. Small metal tubes were inserted in the teats of the cows, and when this was done by unskilled persons, as was generally the case, much damage was done to the udders of the cows. Even up to the present date these metal tubes have been offered for sale.

During the Great War, 1914–1918, shortage of hand milkers gave a great impetus to the invention of new machines. Unfortunately, these designs were hastily conceived and hurriedly manufactured. The result was that, although a considerable number were sold, the experience gained was not good, with disastrous effect upon the reputation of mechanical milking. In the meanwhile the United States had been quietly investigating and perfecting a machine based upon the invention of a special teat cup by Mr. Daish, of New Zealand. This machine was called the "De Laval," being so-called after Dr. De Laval, the famous Swedish inventor of the cream separator, and who was associated with the American enterprise. After several years of trial and final development, this machine was introduced into Great Britain in 1923 under the name of "Alfa-Laval." The first years experienced considerable opposition and strong prejudice from every quarter. Gradually the confidence lost during the War became restored, and it was soon apparent that a machine had at last been devised about which the Ministry of Agriculture, as a result of their official test, arrived at the following conclusions: (1) The machine worked satisfactorily from the mechanical point of view, and there was no indication that any parts were subject

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to undue wear. (2) The average power required to work the pump was 1.11 h.p. (3) The milking parts are easy to disassemble and to clean. (4) The machine had no injurious effects on the cows, and led to no depression of milk yields. (5) The rate of milking was equal to that of first-class hand milking. (6) From the point of view of hygiene the machine gave excellent results provided the units were thoroughly washed and then sterilised by steam.

That milking machines minimise the danger of infection was a point made by Dr. F. C. Minett, Director of the Research Institute in Animal Pathology, when speaking at Leeds the other day on milk-borne diseases. Alluding to mastitis of the udder, Dr. Minett said that there could be little doubt that infection was spread by milkers' hands from teat to teat. When an outbreak occurred, the best thing to do was to cut off the supply of milk. The next step was to locate the infected cow. That was very difficult, as one infected cow could infect the milk of the whole herd just by being mixed with it, to such a degree as to make it dangerous to human beings. There was less danger of infection if milking machines were used, particularly in large herds. It is estimated that there are over 8,000 Alfa-Laval machines now actually working in Great Britain, whilst the makers claim that there are over a quarter of a million at work altogether throughout the world. This represents more than the total of all other makes put together.

A milking machine is unlike any other farm machinery in that its use is not merely seasonal, and on that account it seems needless to say that the construction of the milker unit and all other parts must be robust so as to ensure durability and good service under continuous daily use. Aluminium and its alloys are very easily attacked and corroded when placed in contact with milk, and on this account should be avoided entirely in the construction of the milker unit. Phosphor bronze with a heavily-tinned finish has been found to be entirely suitable as a material for the construction of milker units, as this metal is not attached or corroded by milk and its durability is good. The rubber parts of a modern milking machine must be of the best surgical rubber obtainable, so as to render the rubber capable of withstanding the effects of steam sterilisation. The motive power for driving the plant can most conveniently be a small electric motor, or, if electricity is not available, a small petrol engine. The power required is relatively small, 17 to 22 units, only requiring 2.1 h.p. to operate them.

It has to be admitted that occasionally a cow will be found which does not take to machine milking, even with the most patient management; such cow should be milked by hand or sold.

Milking machines of a reliable type, properly installed and carefully operated and cleaned, give results in every respect equal to those obtained by good hand-milking. The most vulnerable point for the contamination of milk is between the udder and the milk pail. This is more particularly the case if the pail is an open one. Not only is dust continually settling down into the milk during the process of hand milking, but the action of the hands shakes downwards into the

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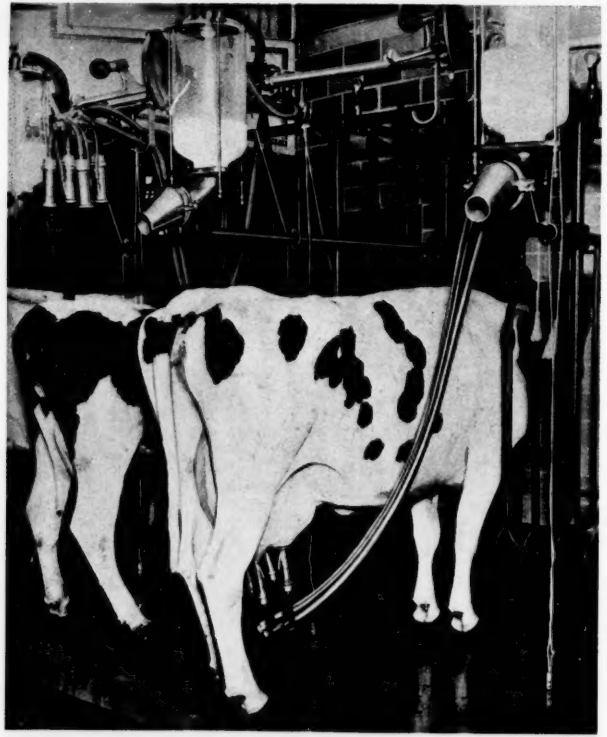

The Walker-Gordon Milking System. Standard Alfa-Laval Magnetic Teat-Cups and Udder Pulsators in use. The milk is drawn into glass jars.

The Walker-Gordon Milking System. Cows coming in to be milked, through a narrow tiled passage.

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milk any dry dung or dirt which may be attached to the hairs of the udder. A milking machine obviates all this. The milk does not come into contact with any air until the process of milking each cow is finished. It is also possible to arrange so that the milk is taken from the teat cups through a suitably designed pipe line, and delivered into a vacuum tank, where it is cooled and run straight into the transport churns.

A glance at the results of Clean Milk Competitions carried out throughout the country clearly establishes the fact that mechanical milking has an advantage over hand milking by obtaining cleaner results with less labour. Probably the most dramatic development in mechanical milking has been the introduction of what is known as milk parlours in the United States. These are about to be introduced into this country if any progressive milk producer will go to the expense of putting up the necessary buildings. A certain Mr. Walker-Gordon, of Plainsboro, New Jersey, has installed what is known as a Rotolactor. The herd consists of over 1,500 cows, which are housed in individual byres of 100 each. The byres are connected by a central covered area-way, which in reality converts all the byres into one.

The cows are brought to the Rotolactor through lanes, and are conducted to the revolving platform through a tiled passage-way. As the cow comes to the end of the passage-way she steps on to the revolving platorm, and one after another does so until all the stanchions are filled. When a cow begins her ride around the platform, for the first few feet she is being washed and cleaned ; next an operator cleans and dries the udder, and adjoining him is another operator who does nothing but draw samples of fore-milk from the cows. At this point the teat cups of a milking machine similar to that described above are attached to the cows, and for the rest of the ride until just before the end the cows are being milked. The milk is drawn from the cow's udder, without coming into contact with the air, human hands or any other source of contamination, into cylindrical glass jars, where it can be examined and weighed. As the platform is being revolved, milking continues, and it is possible to see streams of milk running into each of these jars, and the exact amount of milk which each cow produces is visible. As the cow nears the end of a complete revolution of the platform, the milking is then completed, and the operator removes the teat cups from the cow. The milked cow then walks off the platform, through the passage-way which leads down through the centre of the building, and walks back to her individual stanchion in her byre.

Just after the cow which has been milked steps off the platform her milk is released from the glass jar into an automatic weighing device, from which the milk is then electrically released and drawn through sanitary pipes into the milk-bottling room. In the meanwhile the platform keeps on turning, and there is always a cow waiting to take the place of the one which has vacated her position. The milking is thus a continuous process. Each time the platform completes one revolution fifty cows have been milked. After a cow has been milked the teat

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cups are automatically rinsed in cold water, sterilised, and made ready for the next milking revolution.

The whole operation can be watched by visitors from an observation chamber occupying the centre of the Rotolactor. There is at present only one of these machines in existence, but there are a considerable number of milk parlours which consist of the same milking machine with their glass jars, etc., but installed in fixed standings. One fact which is outstanding from these latest developments is that no one would outlay the requisite amount of money to build these expensive milk parlours unless they were convinced beyond all shadow of doubt that mechanical milking with a well-designed milking machine is not detrimental in any way either to the health of the cows, the milk yields, or the lactation periods, and, finally, that the spread of disease was not adversely affected by their use.

A BOVINE HERMAPHRODITE.

By R. W. KAURA, B.V.Sc. Toronto, L.V.P. Punjab.
Royal Veterinary College, London.

HERMAPHRODITISM is more frequently observed in swine, caprine and ovine species, is relatively common in equines and canines, but appears to be rather rare in bovines. The following account is of an hermaphrodite animal which had been working as a bullock (No. 147 H 2/4) at the Government Cattle Farm, Hissar, India. The animal was born at the Farm, and was never castrated or otherwise operated upon its genitalia. The other progeny of its sire (Bull No. 137 H 4/9) and the dam (Cow No. 312 H 4/9) had never shown any similar defect in their genitalia.

General Appearance and Habits.—In this respect the animal resembled a bullock, but the examination of the external genitalia would point more towards a cow. One would not suspect the defect unless the genital organs were examined or the animal micturated, when it kept the hind legs wide apart and slightly flexed, and the back arched as is generally seen in cows, and the urine passed in a continuous stream from an unusual opening. Perverted sexual desire was not very marked. After the usual training the animal proved to be a very smart, sturdy and useful bullock under the plough, and for draught work, and was never a troublesome animal.

External Genitalia.—The opening through which the urine was passed greatly resembled the vulva of a cow excepting that it was very small, about $1\frac{1}{4}$ in. by $\frac{1}{2}$ in., and had a tuft of hair around it. It was situated just behind the udder in between the hind legs, about 15 in. below the anus, and was leading into a firm tubular structure which would feel like a penis. No penis or testicle could be palpated externally. The mammary gland and the teats showed slight development, but nothing like a normal udder. The animal could yield no milk, but a little dirty watery fluid could be taken out on stipping.

Internal Genitalia.—After the death of the animal the internal genital organs which represented both the sexes were removed. They were imperfectly developed.

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Photograph showing the internal genital organs of a bovine hermaphrodite "bullock."

(*Article by* R. W. Kaura, *page* 186)

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The photograph of the internal genital organs, taken after their removal from the body, shows two testicles with feeble indistinct vas deferentia, two comparatively small ovaries with Fallopian tubes entering the horns of the uterus. The uterus, of course, seems to be relatively small, but the vagina is unusually long, and it continues further to form a narrow tube which opened externally for the passage of urine. The opened portion of the vagina shows the opening of the urethra (urinary meatus) near the centre.

THE DOUBLE INTRADERMAL TUBERCULIN TEST.

By JOHN C. COLEMAN, M.R.C.V.S.
Swindon.

As a contribution to the " Special Dairy Cattle Number " of THE VETERINARY JOURNAL, I submit a few notes upon the above subject.

It cannot be denied that the test is one of many difficulties and pitfalls; especially is this so to those who have not had considerable experience, and have not become more or less familiar with the test. If only for this reason, members of our profession should do their utmost to make themselves proficient, as for once we have something which can never be done by Tom, Dick and Harry. I propose to describe the test in detail so far as my vocabulary will allow me to do so. Articles required to conduct the test: Two hypodermic syringes and needles; a pair of human hair clippers; a pair of small engineer's callipers, and metal 4-inch rule in mm.; bottle of surgical spirit, small paint brush, and chart for recording; and, most important of all, a reliable tuberculin. A Record 1 c.c. syringe, with 7/10 mm. × 15 mm. needle is the maximum calibre recommended. The callipers should be provided with a spring and long screw to set them at required width.*

The site usually chosen is the side of the neck, about half way down. I prefer a position in the hollow just in front of the scapula, for the reason that a slight movement of the animal is not so likely to break your needle or interfere with the injection of the tuberculin. Having chosen your position, proceed to clip the hair in a square 1½ in. by 1½ in., then take a fold of the skin between thumb and finger and carefully measure the double fold with the callipers, recording the measurements as " initial " measurements on chart. With the paint brush slightly moistened with the surgical spirit rub over the clipped patch, and pass on to repeat this operation to the rest of the herd. By this time the spirit should be dry on the first beast done. In no case inject the tuberculin until it is dry; its object is in the direction of producing asepsis.

To inject the tuberculin: Having *securely* fixed your sterilised needle to the sterilised syringe, insert it in the bottle of tuberculin through the rubber capsule and draw into the syringe 1/10 c.c. *only*. Expel any air there may be in syringe, as this is most important: no air must be allowed to be injected with the tuberculin. Now take between thumb and finger a fold of skin, as was done

* In my opinion the instruments in general use are far too clumsy, and make firm measurements impossible.—J.C.C.

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for the measuring, pinching it fairly tight ; if necessary refer to the measurements of the particular animal : take it that this is 5 mm. ; it must be remembered that this is a double fold, and also some connective tissue ; it must therefore be realised that to get the tuberculin into correct portion of the skin, that the needle should not pass deeper than about 1½ mm. from the surface. The injection should be made in the centre of the clipped space, and the syringe and needle must be held almost parallel to the skin, inserting the needle about 10 mm., and upon pressing down the piston, which sometimes is not easy, a small pea-like swelling should appear between the finger and thumb. Proceed in like manner with the remainder of the herd, always being careful to judge leaving 1–2 mm. thickness of skin beneath the tuberculin.

In bulls the thickness of the skin may be as much as 17 mm., or even more. It is often impossible to feel the pea-like swelling in these animals, and I often select a site for the injection in the thinner skin inside the elbow.

At the forty-eighth hour proceed to the second stage of the test. Examine very carefully the site of inoculation. Record measurements, noting any swelling which may be present, and particularly the characters of the swelling, *i.e.*, as to whether it is a hard circumscribed, the size of a pea, or even a hazel nut, and similar in shape, or whether the swelling be of an œdematous nature and more or less diffused. It may often be definitely stated to be a reaction at this stage, but in most cases it is advisable to now inject another 1/10 c.c. of tuberculin as nearly as possible into the same site as the first injection. Record the measurement before injecting.

At the seventy-second hour proceed to very carefully examine and note any changes which have occurred since the forty-eighth hour. It will be observed that many cases which showed only an indurated and circumscribed swelling at this period now present a markedly diffused and œdematous swelling, which varies in shape from being more or less round to oblong, and the diameter may vary from ¾ in. to 10 in. The measurement of the skin in a reactor may vary from 12 mm. to 60 mm. All these measurements should be recorded on the chart. Below I give my chart illustrating a few selected cases from my record. Here let me accentuate the fact that it is *the character* of the swelling and not the measurements of the skin which denote whether an animal is a " reactor " or " non-reactor."

I desire to emphasise the necessity of observing care in handling the sites of injection for the purpose of ascertaining the information mentioned above—let the feeling be gentle. To ascertain the extent of the diffuseness, take a fold of skin between thumb and finger at site of injection as for measurement, and slowly pass them to the outside of swelling ; or in other words, to where the skin is observed to have become normal in thickness : this will give you the extent of the diffuseness. It will now be understood that it is the *diffuse* and *œdematous* swelling, no matter how small, which denotes a reactor, *entirely* disregarding

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any measurements, to arrive at a conclusion. The chart below explains itself, but I would call particular attention to Nos. 102 and 108.

If I have succeeded in removing some of the difficulties experienced by quite a few of my *confrères*, I shall feel that I am rewarded for my task. But even now I am not sure that the phraseology used to define what is a reaction conveys quite what I could more easily demonstrate.

102.—This cow was said to be giving tuberculous milk by biological test. My microscopical examination of milk was negative : no reaction to test. Post-mortem examination revealed no macroscopical lesions either in udder or any other organs. Portions of the udder sent to Cambridge laboratory for exhaustive examinations, including inoculation of three guinea-pigs, all with negative results.

94.—Condemned at forty-eighth hour. Lesions at post-mortem : all organs in thoracic and abdominal cavities very badly affected with tuberculosis.

96.—Post-mortem : Miliary tuberculosis both lungs and mediastinal glands.

97.—Post-mortem : Pulmonary tuberculosis very bad, also mediastinal glands.

148.—Very emaciated, did not react to " Johnin." Lesions observed : small tubercular site the size of a pea on posterior margin of left lung, and small site in supra-mammary gland.

108.—This cow was also very emaciated, but did not react to " Johnin." Post-mortem : one mesenteric gland tubercular, the size of a hen's egg.

Number	Measurements in mm.			Diameter of swelling :		Result
	Initial	48th hour	72nd hour	48th hour	72nd hour	
102	7	10	14	$\frac{3}{8}$ in.	$\frac{3}{4}$ in.	—
94	7	v.d.o. 20	—	5 in. × 3 in.	—	+
96	5	c.i. 11	v.d.o. 22	1 in.	$2\frac{1}{2}$ in.	+
97	6	c.i. 11	d.o. 20	1 in.	$1\frac{1}{2}$ in.	+
148	6	s.d.o. 9	d.o. 18	1 in.	$1\frac{1}{2}$ in.	+
108	7	c.i. 7	s.d.o. 11	$\frac{3}{4}$ in.	1 in.	+

Abbreviations denote : v very ; d diffused ; o œdematous ; c concentrated ; s slight ; + reactor ; — non-reactor.

THE USES OF EPIDURAL ANÆSTHESIA IN BOVINE PRACTICE.

By GEOFFREY BROOK, B.Sc., M.R.C.V.S.

Veterinary Education Officer, Derbyshire.

WHEN a new method has been under consideration for some time it is always of interest, and not infrequently of value, to review its uses in the light of experience and re-assess its position in routine practice. On these gounds it was felt that a consideration of epidural anæsthesia in cattle would be of some interest. Since its introduction by Benesch, in 1926, a sufficient period has elapsed to judge of its advantages and to appreciate some of its disadvantages. As the technique of

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injection and the dosage have been discussed elsewhere, and have not been modified, these will not be reconsidered. It is proposed to deal with the subject by answering the following series of questions which might occur to the clinician proposing to give the method a trial: (*a*) What are the indications for and contra-indications against the use of spinal anæsthesia in field work? (*b*) What are its advantages and disadvantages in the parturition case? (*c*) Is epidural anæsthesia advantageous in a case of uterine eversion? (*d*) Is this form of anæsthesia helpful during the removal of retained fœtal membranes. (*e*) Is it a suitable anæsthetic in the surgery of the penis in the bull?

(*a*) *What are the indications for and contra-indications against the use of spinal anæsthesia in field work?*—The decision as to whether this form of anæsthesia is or is not suitable in any give instance is governed by three factors. The first, a most important one in a busy practice, may be termed the "time" factor. If the extent of anæsthesia necessary to block a selected area is large, it may take twenty minutes or longer before anæsthesia is established. The second factor turns upon the necessity or otherwise of cutting off control of the hind limbs. If this supervenes, appropriate preparation must be made, and the surgeon may think it necessary to remain until the patient can rise again. The final factor is the economic one: if a large amount of solution must be used, it may be advantageous to select other methods. With these points in mind, consider the amputation of a teat. To anæsthetise the udder it has been shown that there is a developmental period of about twenty-five minutes, that the control of the hind limbs is abolished, and that about 30 c.c. of solution must be injected. Obviously, local anæsthesia of the base of the teat would be much quicker in establishment, equally humane and less expensive.

It is thus possible to formulate the general rule that if it is unnecessary to affect hind limb control in order to anæsthetise a given area or organ, then epidural anæsthesia is probably the quickest, most effective, and cheapest method. If, however, the nerves to the hind limbs must be blocked, and, *inter alia*, large amounts of solution are necessary, then other anæsthetics are probably preferable, except in the case of prolonged operation (*e.g.*, Cæsarean section, ablation of the udder). On this basis a list can be compiled of indications and contra-indications:

Indications.—All operations on the tail, perineum, anus, rectum, vulva, vagina, cervix, pelvic and peroneal urethra and bladder; ovariotomy; uterine eversion; dystokia; embryotomy; selected instances of retentio secundarium and of uterine irrigation.

Contra-indications.—General surgery of the hind limbs and udder; testicles (*e.g.*, castration); simple laparotomy; simple operations on the penis of the male.

The following conditions are those in which the use of epidural block method must be left to the discretion of the operator: Detailed surgery or prolonged operations upon the hind limb, udder, penis, testicles and associated structures; and within the posterior abdomen.

(*b*) *What are its advantages and disadvantages in the parturition case?*—Chief amongst the advantages is the abolition of pain. The relief of suffering

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must ever be the concern of the qualified practitioner, and is the hall-mark of his work as contrasted with that of the " quack." On these grounds alone the writer appeals for the more general use of the method. A second advantage, as recently shown by Benesch, is that with a correct dosage the contractions of the uterus are not interfered with, and involution remains unaffected. This dispenses with the argument advanced by some that natural aid to delivery is abolished. Thirdly, " straining " is discontinued ; this ensures a greatly increased standard of cleanliness throughout obstetrical practice ; fœtal manipulations are tremendously facilitated, and thus, for instance, risk of uterine rupture, not unknown during elevation of the hind limbs in certain presentations, is eliminated. Finally, the site of hæmorrhage, if present, can be more easily located, and the vessels picked up.

The disadvantages which the writer has detected are three in number : Firstly, vaginal or cervical tearing once commenced is more extensive. The flaccid tissues appear to tear more readily than when possessing their normal tone and elasticity. This is merely an indication for greater care and more liberal lubrication during delivery. Secondly, hæmorrhage, if it does occur, is usually more pronounced, since the ruptured vessels receive no support from the flaccid tissue which normally might contract upon and close them. Finally, the voluntary help of the mother is completely abolished. In instances where considerable traction is necessary, and where uterine tone in any case remains unaffected, the writer feels that the advantages gained in ease of manipulation, cleanly procedure and avoidance of pain, easily outweigh this disadvantage.

(*c*) *Is epidural anæsthesia advantageous in a case of uterine eversion* ?— In the experience of the writer, epidural anæsthesia facilitates the replacement of an everted uterus. It is not, however, a method which solves all the associated difficulties. Despite its use one still finds it necessary to elevate the hind quarters of the patient ; if loops of bowel are lying within the eversion, the only factor that can correct their position is elevation, but since anæsthesia abolishes " straining," there is far less tendency for the bowel to re-enter the eversion. Again, some maintain that to abolish periodical " straining " is to eliminate that set of forces which are so useful in reducing the volume of the everted mass. In practice one finds that reduction in volume under epidural anæsthesia is brought about quite readily by use of an enveloping sheet or a Scott's valise. It is most important to so estimate the dose that the uterine nerves are not blocked. If these are affected it will be found that the replaced organ remains uncontracted and ballooned ; under these conditions a mechanical re-eversion of the ends of the uterine horns may and frequently does take place. When involution eventually comes about, the eversions are sealed in place, adhesions are set up, and complications arise. If an excessive dose is inadvertently given, it is wise to pay a second visit a few hours later to make sure that partial re-eversion has not taken place.

In instances of impending eversion, as, for instance, after a prolonged parturition, epidural anæsthesia is an ideal preventive. Pain and straining are abolished,

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the affected parts have a chance to contract in position, and the congestion to subside.

To recapitulate: the epidural method abolishes straining, conserves the strength of the patient, facilitates replacement, ensures greater cleanliness, and constitutes an ideal protective measure in threatening cases. It does not obviate the necessity of elevating the hind quarters; the chief danger is the induction of a too-extensive anæsthesia, which may lead to a mechanical re-eversion of varying degree, unless the surgeon familiarises himself with the correct dosage.

(*d*) *Is this form of anæsthesia helpful during the removal of retained fœtal membranes*?—Epidural anæsthesia is of value when the patient is exhausted, if there is risk of "straining" occurring after removal of the membranes, or where bruising and laceration from the recent parturition renders the operation extremely painful. All clinicians have met the animal which is so weak from bad husbandry, premature pregnancy, a twin pregnancy, dystokia or post-partum infection that removal of fœtal membranes is a really dangerous drain on the strength of the animal. Not infrequently such a patient is one that has been "straining," or is likely to commence. In such instances anæsthesia is invaluable. Moreover, the womb can be very thoroughly washed out by the syphon method. The employment of anæsthesia demands the adoption of the syphon method, since the ability to expel fluids is temporarily suppressed.

(*e*) *Is it a suitable anæsthetic in the surgery of the penis in the bull*?—It is generally agreed that to anæsthetise and induce extrusion of the penis by the epidural method, the dose necessary is such that the power of the hind limbs is abolished. Thus, while all agree that the resultant anæsthesia is so perfect, and the relaxation and exposure of the penis so helpful, there arises the disadvantage that an ofttimes unusually powerful patient will pass through a phase of inco-ordination during the onset and termination of the anæsthesia. It is therefore necessary to "cast" the animal before inco-ordination sets in. If this is not done—and as is illustrated by Stinson—there is grave risk of damage to a half-extruded penis during struggling. For the same reason, the animal must be kept on the ground until complete control of the limbs is re-established. This usually entails loss of time to the surgeon in the field. It thus resolves itself into a choice between the use of a surgically perfect anæsthetic, with the expenditure of some time, or the use of the less satisfactory general or local anæsthetics.

It is impossible in the scope of this article to deal with the many instances in which spinal anæsthesia may or may not be used. The best guide, as always, is practical trial. The opinions advanced above have been formed by attempting the treatment of a condition alternately with and without epidural anæsthesia. Those who have given the method no trial should apply it before sitting in judgment. Their criticisms will then be very valuable. The method of injection is easy even under field conditions, the solutions in use readily obtainable and not too expensive. Purely from the clinician's standpoint the writer recommends the procedure as one calculated to avoid and relieve suffering, facilitate procedure, raise the standard of cleanliness, gain the approval of the enlightened owner, and harden his heart against the old enemy—quackery.

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